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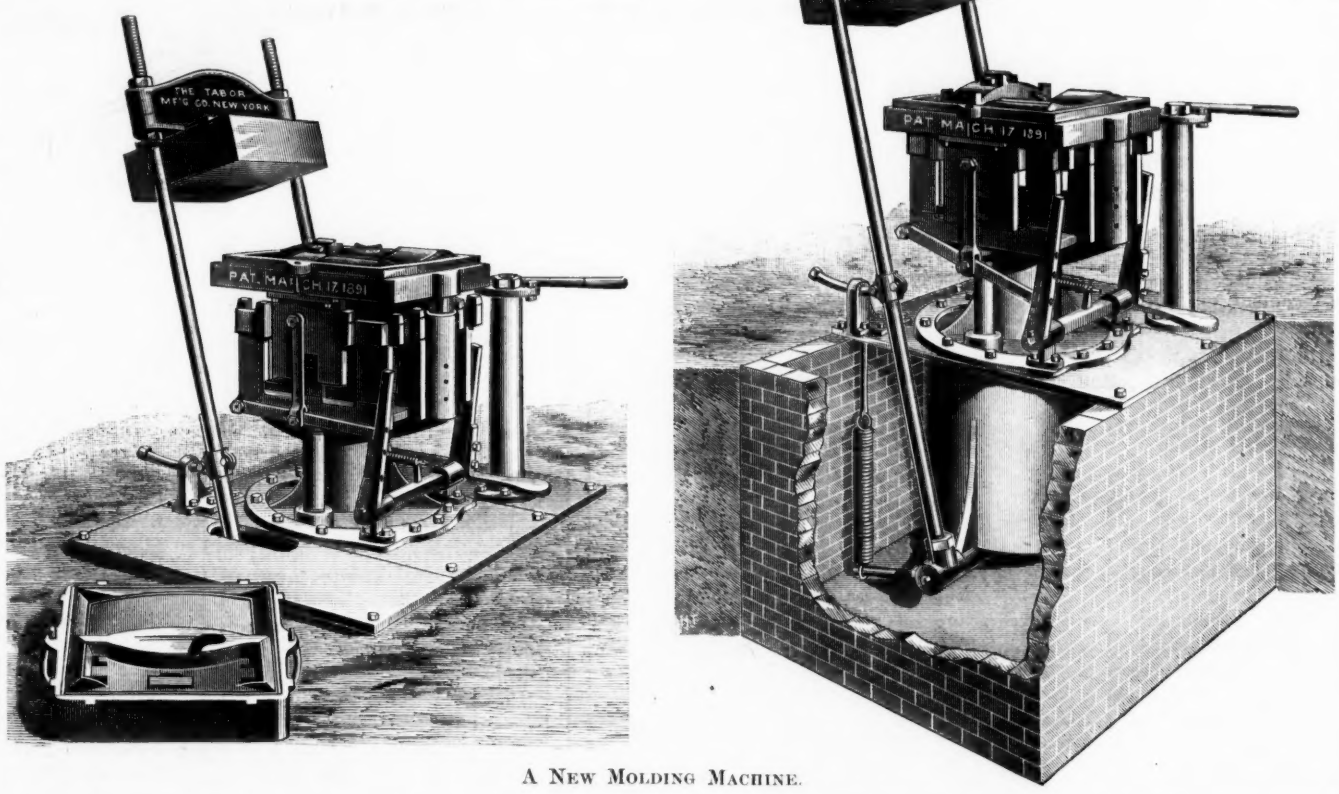
## A New Molding Machine.

In our issue of July 31, '90, we illustrated and described a molding machine made by the Tabor Manufacturing Company, of 111 Liberty street, New York, which was fitted up for making standard car couplers, the machine being, in respect to size and general features, adapted to work of that and similar character. With this we illustrate a smaller machine, which has recently been perfected by the same builders, and which we have seen in operation at the shops of the Samuel L. Moore & Sons Co., at Elizabeth.

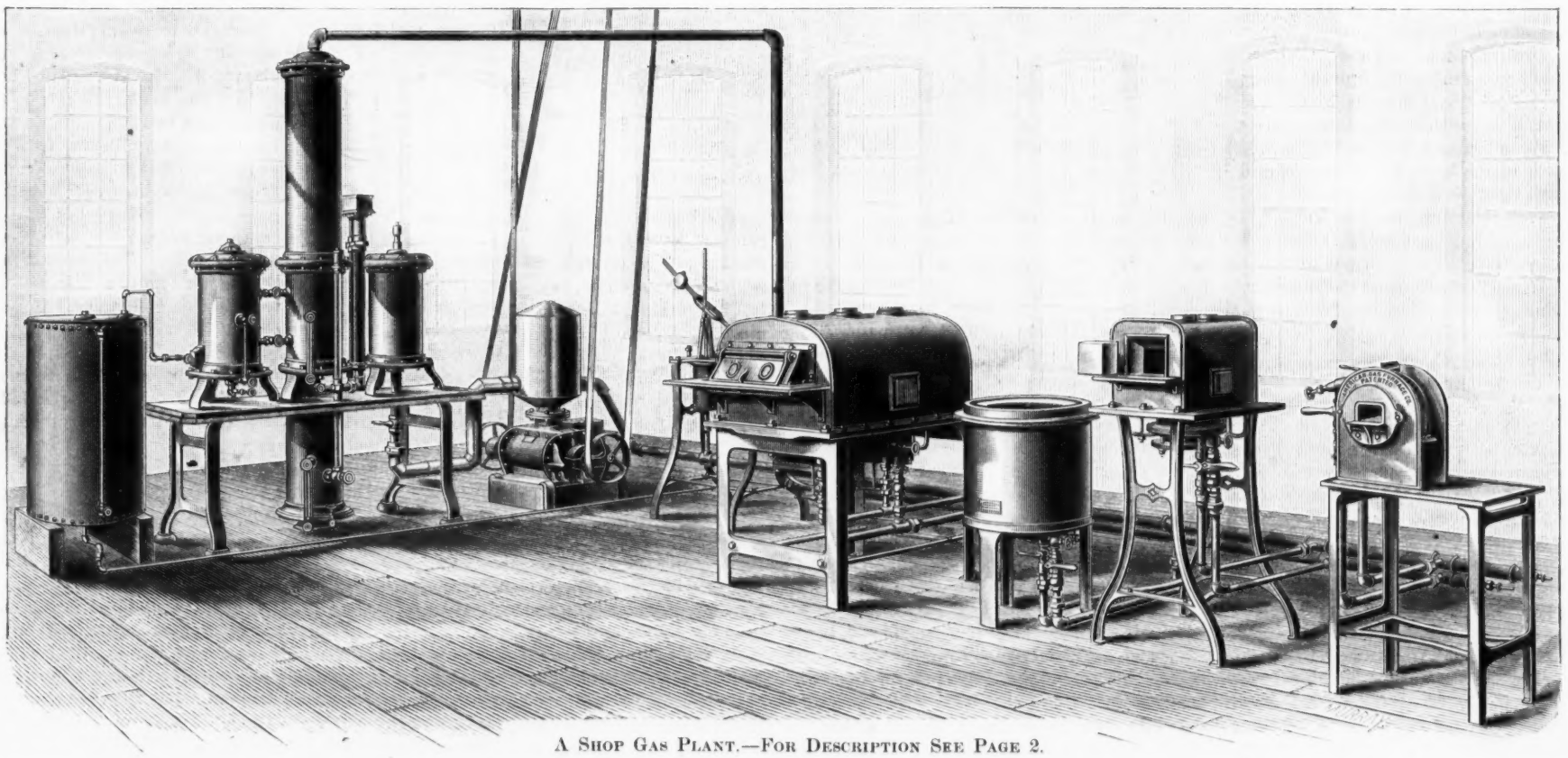
The machine is employed at present in making brake shoes for railway cars, and it is at once evident to any one witnessing the operation of the machine that it is making shoes which are superior to those ordinarily made by hand, and as to the rate at which they are made it is perhaps best to state the actual observed time as noted by the writer, within which a mold was made and placed on the floor, ready for pouring.




A NEW MOLDING MACHINE.

The machine is what is called a 16-inch, that being the size flask intended to be used on it. In this case the flask was 14″x17½″; patterns being arranged for two shoes, which are cast in an inverted position with respect to each other; *i. e.*, of two shoes cast in the same flask, one will be cast face upward, while the second will be the other side upward. The machine is attended by a man with some experience, and he is assisted by a boy, each having certain routine operations to perform, which are repeated exactly for each mold. The "drag" or lower part of a mold is first made, and when a lot of these are completed and put on the floor, some slight changes are made in the arrangement of the machine, requiring but very few minutes to complete, and copes are then made, the arrangement of the patterns in reverse position, as noted above, making the drag and cope just alike, and doing away with the necessity for any change in the patterns.

Timing the machine, it was found that in making the drag the time required to make a complete cycle of movements, *i. e.*, the time from the placing of one drag on the floor to the placing of another beside it, was 34 seconds; the distance walked with the drag being, in this case, about 20 feet. In the case of the cope, 35 seconds were required, thus making the time for a complete mold 1 minute 18 seconds, which is at the rate of something over 46 complete flasks or 92 shoes per hour. No special effort was manifest during this time, yet no one familiar with manufacturing operations would expect this rate to be maintained for a day, nor even for an hour, under ordinary circumstances; yet after seeing this time made it is evident that Mr. Harris Tabor's statement, that 25 molds per hour are easily practicable with the machine, is far within the range of its capacity, as, indeed, he intends it to be. In fact, machines are in use on which this is very much exceeded, the product depending



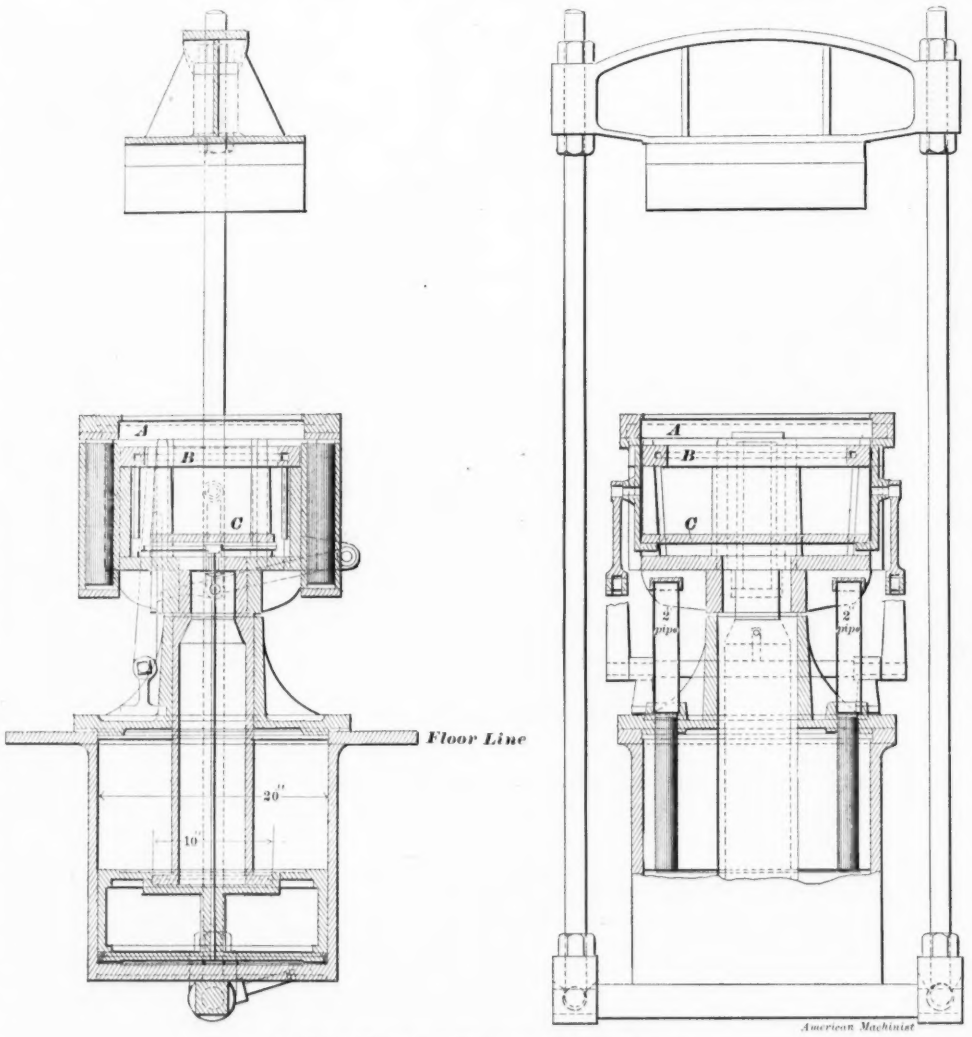
A SHOP GAS PLANT.—FOR DESCRIPTION SEE PAGE 2.

largely, of course, upon the character of the work, and the arrangements made for facilitating it.

Reference to the engravings on this and the preceding page shows that, while the same principles of operation have been retained in this machine that were in the former one, the arrangement is essentially different, since in this case no carriages are used, but instead the pattern frame, stripping plate, etc., are placed directly above the cylinder, attached to the upper end of the piston rod.

One of the cuts on page 1 shows the floor cut away to give a view of the part of the machine below the floor line, and on this page sections of the machine are given which have been made from working drawings. The piston takes steam on the under side only, its weight being sufficient to return it promptly after the mold is rammed.

To the piston rod is attached the principal part of the mechanism, consisting of a table with lugs projecting upward, and supporting the pattern frame *B*, upon which rest the patterns; the stripping plate frame *A* directly over the pattern frame, and resting on it, to which the stripping plate is attached; the stool plate *C* suspended to the stripping plate frame, and moving with it; side levers and tumbling shaft for tripping after the pattern is drawn. The pattern frame has an annular passage which is connected to the cylinder by the small pipe shown, the object of this being to admit some steam to the pattern plate at each movement of the piston, this steam serving to keep the patterns moderately warm, preventing "sweating" or accumulation of moisture from the atmosphere, and making them draw from the sand more freely and smoothly. The stripping plate frame is guided by two bored sockets, one at the front, and the other at the back of the machine, there being air holes below the pistons, by which any desired amount of cushion can be obtained for the drop of the stripping plate frame. The stool plate is really part of the stripping plate frame placed below the pattern frame, and its object is to support stools or internal parts of the stripping plate used in holding green sand cores, or heavy bodies of hanging sand, while the pattern is being drawn. The side levers are pivoted at one end to the table, and are connected at the middle, by links, to the stripping plate frame, the outer end being free. The tumbling or tripping shaft is in front of the machine, near the floor, and has arms projecting upward along the line of travel followed by the free ends of the side levers; on these arms are stops which engage with the free ends of the levers on the downward motion, to draw the pattern.




A NEW MOLDING MACHINE.—SEE PAGE 1.

The ramming head is carried by the wrought rods seen at either side of the machine, these being attached to a horizontal shaft at the bottom of the cylinder, which allows them to be swung forward and back as shown, a spiral spring being used to counterbalance the weight. The ramming head is usually of wood, roughly cut out over the pattern, to avoid too hard ramming on the high places. This block may, of course, be readily changed to suit any flask within the capacity of the machine. The stops on the stripping plate can be also changed to suit any pattern within the range of the machine. The steam pipe enters the cylinder at the bottom, and from the throttle valve to the cylinder serves also as an exhaust pipe, the throttle valve being a two-way cock by which steam is either admitted or exhausted from the cylinder.

The operation of the machine is very simple. The half flask is put on the stripping plate, with the sand-box to hold the sand which is to be compressed, and both are filled with sand. The ramming head is then swung forward over the flask against stops which define its position, and the throttle valve opened. The upward motion of the piston and attached parts carries the flask and sand up to the ramming head, where it is rammed instantly, and upon the throttle valve lever being moved again, steam is cut off, and at the same time exhausted, allowing the flask to descend; the stops then engaging the free ends of side levers, and arresting the downward motion of the stripping plate at a point about midway; the pattern, continuing to descend, is drawn from the mold, and when the piston has returned to its lowest position the sand is struck off the flask, which is then taken from the machine. As the man removes it he presses the tripping treadle with his foot to release the stripping plate frame, which then falls to its proper position with respect to the pattern, and the machine is then ready for another mold.

Water or compressed air may be used instead of steam, if it is desirable, though it is believed that steam is preferable in most cases; because it is usually easily obtained without the use of other special auxiliary machinery of any kind; it is cheaper, and the steam appliances coming under the charge of the fireman or engineer, the foundry is relieved of the care of them The machines are, of course, built of any desired size, according to the work to be done.

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A recent (Duluth, Minn.,) dispatch to the *Tribune* says: Captain McDougall, for the American Steel Barge Company, has signed a contract for the construction of steel freight steamers for lake traffic, all of which are to be completed and ready for use by the opening of navigation next spring. They will be of the "whaleback" style, and are to be 306 feet long, 38 feet beam, 24 feet depth of hold, and are to carry 2,500 gross tons on 14 feet six inches draught, with a guarantee of 25 tons additional capacity for each additional inch of draught. These will increase the number of steamers and barges to be turned out by the yard this winter to sixteen, and the gross tonnage to over 50,000.

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It has been thought that a test between the different types of rapid-firing guns would soon take place. Now it is said that some of the builders of such guns are induced to pull out, leaving a test improbable, all of which is too bad, if true.

## A Shop Gas Plant.

(*For Illustration See Page 1.*)

In our issue of June 18 we described a gas-making plant which was put in at the new works of the Crescent Watch Case Co., by the American Gas Furnace Co., of No. 80 Nassau street, this city. In this case it will be remembered that there was a large gas holder which formed part of the plant, this gas holder being put in for special reasons which do not obtain in ordinary cases. We did not illustrate the watch case company's plant, for the reason that we were aware that a plant was being constructed which would be more nearly the ideal one, as it would be made for machine shop use.

The illustration on page 1 represents a plant which was made for the firm of Blohm & Voss, shipbuilders of Hamburg, Germany, who are to use it in their tool-making department. The order for this plant was given after an inspection of an experimental plant which was erected at the shops of the American Gas Furnace Co., Mr. Voss visiting the works while on a visit to this country, whither he had come as a delegate to the Iron and Steel Convention. As part of the contract, it was stipulated that the whole plant should be erected and operated in the shop before shipment, in order to thoroughly test its working, this test being witnessed by a representative of this paper who was invited to the shops for that purpose. The plant, as erected on the shop floor ready for testing, appeared as shown in the engraving, everything pertaining to it being on the one floor, as shown, and in plain view.

On the extreme left is a tank from which the oil was drawn for making the gas, next to this, at the right, being the gas-making machine proper, at the right of which is a Root blower for supplying air under pressure, this blower being driven by the belts seen, which come from a countershaft overhead not shown in the engraving.

On top of the blower is an accumulator which steadies the blast, from this being led two pipes, one of which goes to the gas machine, while the other supplies air to the furnaces for combining with the gas just before ignition. Next on the right, and partially concealed by the larger furnace, is a device which controls and automatically suspends the gas-making process whenever the desired maximum pressure is reached. At the right of this come the four furnaces which were operated during the test, these being first, an oven furnace having an interior working space 20″ wide, 26″ deep and 6″ high, and an opening 18″x4″; a soft metal furnace with cast-iron pot 10″ diameter and 10″ deep; a muffle furnace having an interior working space 5½″x4½″, 10″ deep, and a "No. 1" gas forge suitable for the forging usually required in tool making.

Of course it is understood that this does not represent the actual arrangement of the furnaces as they will be placed in the shop, since they can, of course, be arranged in any manner that is most convenient, in one or in several different rooms.

During the test there were five Welsbach burners supplied with gas from the machine, and these were kept burning, giving an excellent light of great brilliancy.

In our issue above referred to we described at some length the process of making the gas, and gave the proofs that it was for all practical purposes a fixed gas; and it is necessary to say here only that the tank at the left of the engraving, containing the oil, was connected at the bottom with a water supply, the pressure under which the water was supplied being just sufficient to force the oil up to the desired height in the machine. A gauge glass showed at all times the height of the oil in this tank, which was placed there for convenience during the test only, since it is not an essential part of the plant, as the oil would ordinarily be drawn from a large tank which might be under the floor or in any convenient place.

Flowing from this tank into the cylinder at the left of the machine, it is submitted to the pressure of air, and by a valve which is controlled by a float is fed to the central cylinder as required, flowing into it near the bottom, where it comes into contact with a vertical jet of air by which it is taken up and thrown into a sort of combining tube.

On emerging from this tube the mixed air and oil are forced through a series of perforated plates placed one over the other and graduated as to fineness of perforations in such a way that the vapor which finally goes through the uppermost one is, as conclusively shown by tests, a fixed gas for all practical purposes, since it is formed by a mixture of atomized oil and dry air at a pressure above that to which it is afterwards subjected, and at a much lower temperature. The lowering of the temperature results from the vaporization and expansion of the air and oil on emerging from the combining tube, and the reduction is to a point considerably below freezing, the result being that all vapor of water held in suspension by the air is frozen, and, being separated, falls to the bottom, as ice, where the warmer oil melts it, and it is drawn off as water. This separation of water from the air greatly increases its capacity for absorbing oil, the result being a gas which is, like ordinary city gas, deficient in oxygen, which must be supplied for perfect combustion by air which is mixed with it at the furnace, and the regulation of which assists in giving perfect control of the furnace.

No accumulator or gas holder is needed in such a case, since gas is formed that is ready for use as soon as the blower is put in operation, and is made as fast as is necessary to supply the place of what is drawn out for consumption.

It will be noted that force is the main reliance for securing a thorough mixture of the atomized oil with the air, the combination being effected at so low a temperature and at such pressure (not less than one pound per square inch) that at ordinary temperature and pressure as the gas is used there is absolutely no separation, even when the gas is kept confined in pipes for months.

The machine illustrated occupies a floor space 6x3 feet, and is ten feet high to the

discharge pipe, its capacity being 10,000 cubic feet of gas per hour, requiring about 25 gallons of oil.

The plant, as shown in the cut, being made ready for the test, the height of the oil was marked on the gauge glass provided for that purpose on the oil tank at the left which had previously been calibrated. The blower was then started, and immediately the five illuminating burners were lit, and then the furnaces one after the other, all being cold at the beginning. The time elapsing from the starting of the gas machine until the furnaces were sufficiently heated to perform the work they were designed for, was, in the case of the large oven furnace, thirty minutes; this furnace, being intended for the heating of large pieces of steel for hardening or annealing where great uniformity is desirable, is supplied with very heavy slabs of fire-brick, requiring much longer time to be heated through than the others. At the time noted it was in condition to receive work, being evenly heated throughout. The pot of the soft metal furnace was heated to a bright cherry red in fourteen minutes; the muffle furnace in thirteen minutes, and the forge was sufficiently heated for forging in five minutes.

The forge was in operation 30 minutes when the following welding trial was made: Two pieces of one-half inch square iron welded in 1¾ minutes; two pieces of three-quarter inch square iron welded in 2½ minutes; two pieces of one-inch square iron welded in 3¾ minutes. This includes the time of making good welds on the anvil. In the oven furnace three pieces of steel, respectively 1½″x¾″x17″, 1⅝″x¾″x24″, and 2″x¾″x26″ were heated together in nine minutes to a bright red, and much more uniformly and better than could possibly have been done with any ordinary forge without considerable preparation, and at the expenditure of very much more time.

All the furnaces shown were kept in operation continuously during the run, which lasted just one hour and fifteen minutes, during which time a rivet-heating furnace, not shown, was also operated for about one-half hour. On measuring the height of the oil it was found to have fallen 3¾″, making a consumption of 7½ gallons of oil known as gas naphtha, costing seven cents per gallon in barrels, and supplied to the Crescent Watch Case Co. in tank cars at something less than four cents. Assuming its cost as five cents per gallon, it will be seen that these furnaces were heated up ready for use, and operated for 1¼ hours at a cost of 37½ cents for fuel, this being practically the total cost, except power for blower, because the machine is entirely automatic, and requires no attention except to see that it is supplied with oil.

It is the belief of this company, after considerable experimenting, that the use of such oil as specified above is far more economical than to use the crude petroleum at a lower price, for the reason that crude petroleum contains matter which cannot be converted into gas, and is not consumed. This must be separated from the valuable portions of the oil; or, in other words, the oil must be refined by some process; if not done before it reaches the furnace, then it must be done in the furnace, and this refining will cost more if done in the furnace where the gas is consumed than if done by the refining companies, who have plants specially adapted to the work, and can do it very economically, while the transportation of refined oil costs no more per gallon than that of crude oil.

The entire absence of smoke, ashes and odor, and the fact that furnaces, when once lighted and the valves adjusted to suit the work to be done, require no attention whatever; the even and perfectly controllable heat maintained seemed to make the plant all that could be desired for practical shop use.

After witnessing this test we called at the gold and silver refining establishment of Chas. S. Platt, on Gold street, this city. One of the gas-making machines has been in use here for some time for making gas for furnaces used in the establishment, replacing coal, charcoal, and city gas, which had been previously used. Among the other purposes for which it is used is in heating a special reverberatory furnace used for annealing sheets of silver during the rolling operation, this establishment being equipped to roll larger sheets of silver than are rolled anywhere else in the country. The interior space in this furnace is 6 feet long, 3 feet high, and 2 feet wide, the door being 2 feet by 18 inches.

City gas in New York costs $1.25 per thousand feet, and the gas machine reduces the cost for fuel here to something less than one-third, and the results are so much better, the furnaces are heated so much better and more quickly, that Mr. Platt declares the cost of the fuel cuts little or no figure in the matter, and that if the machine made their fuel cost considerably more than city gas, instead of one third as much, it would still have the preference, for the reason that the difference would be more than made up by the time saved and the better results obtained.

We have been thus particular in getting the data and facts connected with this plant and its operation, because, after a thorough personal examination, we are convinced that many new principles are involved in it, and that it is a matter of considerable importance to all who have heating to do for mechanical operations.

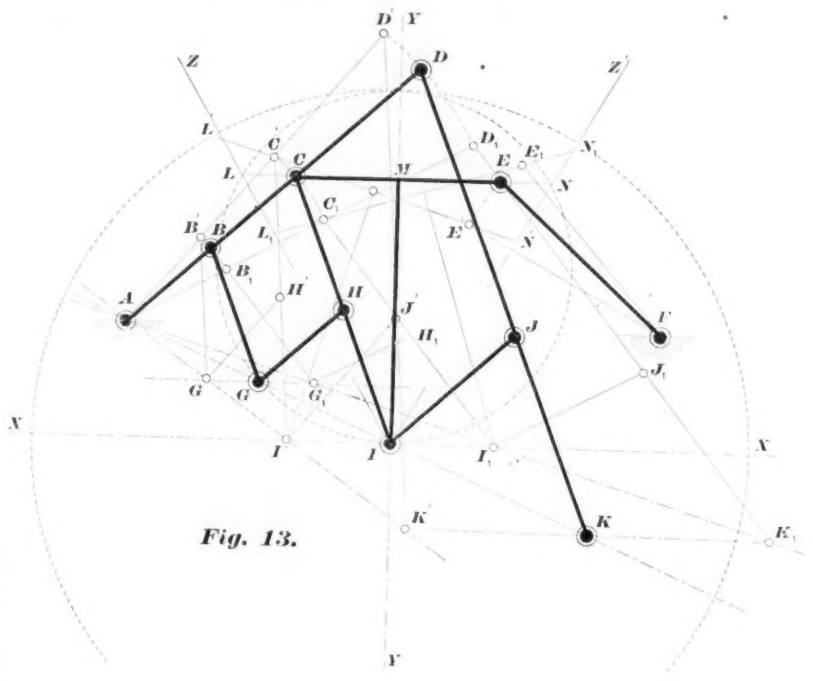


*Fig. 13.*

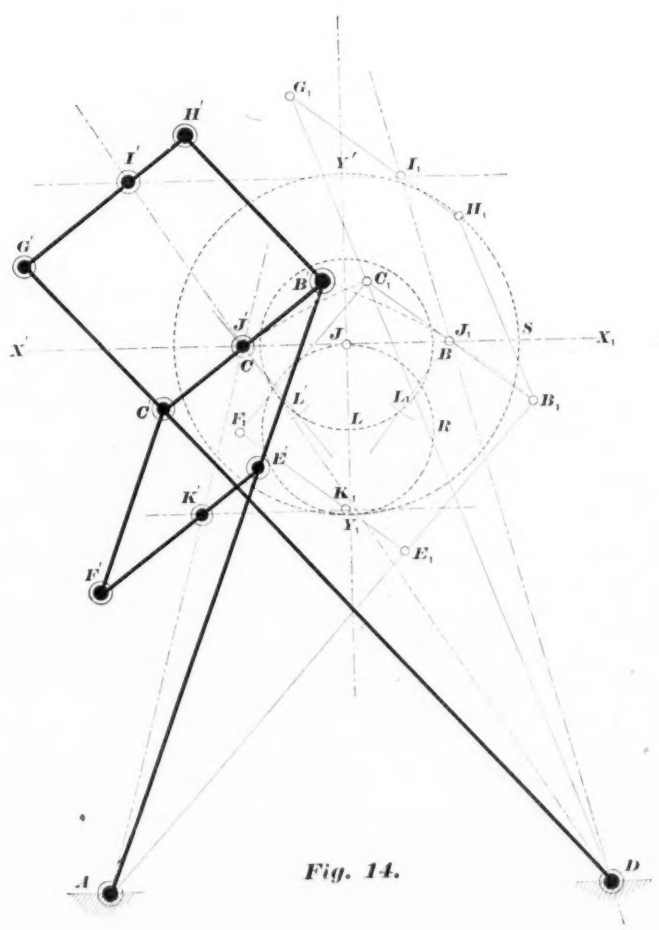


*Fig. 14.*

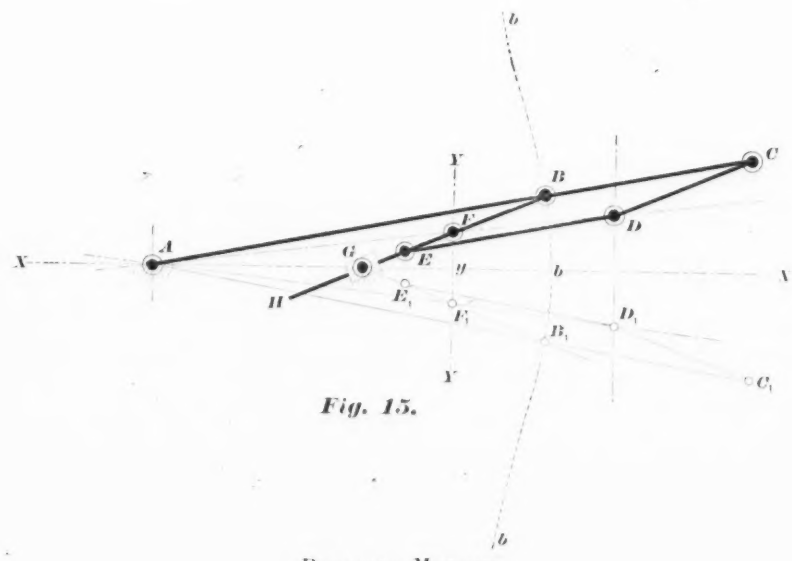


*Fig. 15.*

PARALLEL MOTIONS.

## Parallel Motions.

BY PROF. A. MACLAY, GLASGOW, SCOTLAND.

FIFTH PAPER.

ELLIPTIC PARALLEL MOTIONS.—*Continued.*

*Example* 13.—*To draw a quadric crank elliptic parallel motion of the Roberts type, having three points moving with strokes* $S_1$, $S_2$ *and* $S_3$ *respectively.*

$A\ C$ and $E\ F$ (Fig. 13) are two swinging links centered on pins at $A$ and $F$. $C\ E\ M\ I$ is a T piece coupler joining them together. A point $I$ can be found on the T piece which will move approximately through a limited range of motion in a path which is approximately a straight line, and by connecting $C$ and $I$ and placing parallelograms upon $A\ C_1\ C\ I$, an internal point $G$ and an external point $K$ can be obtained which will copy the path of the point $I$ in any desired proportion.

The proportions for the mechanism may be obtained in a manner similar to that for the last two examples. We may consider the required point $I$ as a point on the circumference, and $C$ and $E$ as two points in a circle rolling within one twice its diameter. Then $I$ would move in a straight line, and $C$ and $E$ in elliptic paths, which can be approximated to by circular arcs.

Let it be required then to design a parallel motion upon this basis, having three points moving with the given strokes, say $S_1 = 2'\ 7''$, $S_2 = 5'\ 0''$, $S_3 = 8'\ 9''$ respectively. (Scale, $\frac{1}{4}$

Draw a horizontal $X\ X$ and a vertical $Y\ Y'$ intersecting at $I$. From $I$ to right and left mark off $I\ I^1 = I\ I_1 = S_2$. Also from $I$ set off $I\ Z$, and $I\ Z^1$ each at 30° with $I\ Y$. Along $I\ Z$ and $I\ Z^1$ measure off $I\ L = I\ N = 1\frac{1}{2}\ S_2$, and join $L\ N$ intersecting $I\ Y$ at $M$. Measure off $M\ C = M\ E = \frac{1}{2}\ S_2$. With centers $I^1$ and $I_1$, radius $I\ L = I\ N$, mark off $L^1$ and $L_1$ on $I\ Z$ and $N^1$, $N_1$ on $I\ Z^1$. Join $L^1\ N^1$, $L_1\ N_1$. On each in turn measure off $L^1\ C^1 = L_1\ C_1 = L\ C$, and $N^1\ E^1 = N_1\ E_1 = N\ E$. Find $A$ and $F$ centers of circles passing through $C^1\ C\ C_1$ and $E^1\ E\ E_1$ respectively. Join $A\ C$ and $F\ E$. Then $A$ and $F$ are the required fixed centers, and $A\ C$, $F\ E$ the swinging links to cause point $I$ on the T piece coupler $C\ E\ I$ to move approximately in the straight line $X\ X$ with a range of motion $I^1\ I_1 = S_2$.

Next for the two other points, which are to move in parallel paths with strokes $S_1$ and $S_3$ respectively. Join $A\ I$, then find a point $G$ between $A$ and $I$ such that $A\ G : A\ I :: S_1 : S_2$. Then join $C\ I$, and through $G$ draw $G\ B$ parallel to $C\ I$, and $G\ H$ parallel to $A\ C$. Again find a point $K$ on $A\ I$ produced, such that $A\ K : A\ I :: S_3 : S_2$. Then through $K$ draw $K\ D$ parallel to $C\ I$ meeting $A\ C$ produced at $D$. Lastly, draw $I\ J$ parallel to $A\ D$. Then $G$ and $K$ are the points required, and $A \ldots K$ is the required mechanism.

Show by drawing the mechanism in three or more positions that $G$, $I$ and $K$ move in parallel paths, which are approximately straight lines, with the given strokes $S_1$, $S_2$ and $S_3$ respectively.

*Example* 14.—*To draw a quadric crank elliptic parallel motion of the Tchebicheff type, having three points moving with given strokes* $S_1$, $S_2$ *and* $S_3$.

$A\ B^1$ and $C^1\ D$ (Fig. 14) are two swinging links centered at $A$ and $D$ respectively. The middle point $J^1$ of the coupler joining them will move in an approximate straight line with a stroke $J^1\ J_1 = S_2$, if the proper proportions are chosen for the links (including the fixed link $A\ D$).

These proportions may be determined simi-

larly to those in the last example, with this difference, that the extremities of the coupler have now to be considered as points *without* the rolling circle instead of within. Thus, referring to Fig. 14, $J$ is to be considered as a point on the circumference of the rolling circle $J\ R\ Y_1$, and the points $B$ and $C$ as two points connected with the circle $J\ R\ Y_1$, but lying outside of it. In geometrical language the difference is that in the last example the paths of $C$ and $E$, the extremities of the coupler, Fig. 13, were *prolate* hypotrochoids; in the present example the paths of the corresponding points $B$ and $C$, Fig. 14, are *curvate* hypotrochoids. But, as before, the curves are elliptical in shape, and just in so far as arcs of circles may be made to approximate to parts of them, just so far will the motion of $J$ approximate to the exact straight line hypocycloid, which it would describe as a point on the circle $J\ R\ Y_1$, when it is rolled within the circle $Y^1\ S\ Y_1$, the latter being twice the diameter of the former.

Let it be required then to design a parallel motion of this kind upon this basis, for three points with given strokes, say $S_1 = 2'\ 3''$; $S_2 = 3'\ 3''$; $S_3 = 4'\ 3''$. (Scale, $\frac{1}{12}$.)

Draw a horizontal $X^1\ X_1$ and a vertical $Y^1\ Y_1$ intersecting at $J$. Along $X^1\ X_1$ to each side of $J$ mark off $J\ J^1 = J\ J_1 = \frac{1}{2}\ S_2$. Upon $J^1\ J_1$ erect an equilateral triangle $J^1\ J_1\ Y_1$.

Draw $J\ Y_1$, and on it as a diameter describe the circle $J\ R\ Y_1$ with center $L$. Also with $J$ as center radius $J\ L$ describe the circle $L^1\ L\ L_1$. From $J^1$ and $J_1$ as centers radius $J\ L$ cut the circle last drawn at $L^1$ and $L_1$ respectively and join $J^1\ L^1$, $J_1\ L_1$. Through $J^1$ and $J_1$ draw perpendiculars to $J^1\ L^1$ and $J_1\ L_1$ respectively, and on these mark off $J^1\ B^1 = J_1\ B_1 = J\ B$ and $J^1\ C^1 = J_1\ C_1 = J\ C$. Find now $A$ and $D$ centers of circular arcs passing through $B^1\ B\ B_1$ and $C_1\ C\ C^1$ respectively. Then join $A\ B^1$, $D\ C^1\ B^1\ C^1$, and $A\ B_1$, $D\ C_1\ B_1\ C_1$. These lines represent the required mechanism, and show it in its two extreme positions corresponding to a straight line stroke $J^1\ J_1 = S_2$ of the middle point $J$ of the coupler $B\ C$.

For the other points with strokes $S_1$ and $S_3$ proceed as in the last example. Join $A\ J^1$ and on it find a point $K^1$ such that $A\ K^1 : A\ J^1 :: S_1 : S_2$. Then through $K^1$ draw $E^1\ F^1$ parallel to $B^1\ C^1$ and $C^1\ F^1$ parallel to $A\ B^1$. For the third point with stroke $S_3$, we may for variety of construction place the parallelogram upon the link $D\ C^1$. Thus draw $D\ J^1$ and produce it to a point $I^1$ such that $D\ I^1 : D\ J^1 :: S_3 : S_2$. Then through $I^1$ draw $G^1\ H^1$ parallel to $B^1\ C^1$ meeting $D\ C^1$ extended at $G^1$, and $B^1\ H^1$ parallel to $D\ C^1$. Then $K^1$ and $I^1$ are the required points. Show by drawing the mechanism in three or more positions that $K^1$, $J^1$ and $I^1$ move in parallel paths, which are approximate straight lines with the given strokes $S_1$, $_2$ and $S_3$ respectively.

(8).—CONCHOIDAL PARALLEL MOTION.

*Example* 15.—*To draw a slider crank conchoidal parallel motion, having two points with strokes* $S_1$ *and* $S_2$.

Fig. 15 illustrates the mechanism known as a swinging block slider crank in the Reauleaux-Kennedy nomenclature. $A\ B$ is a swinging link centered at $A$ and attached to a sliding swinging link $B\ G$ at $B$. $G$ is a swinging block turning on a fixed center. $B$ moves in the circular arc $B\ B_1$, while the link $B\ G$ slides slightly backwards and forwards in the block $G$.

A point $F$ can be found on the link $B\ G$, which will move very approximately in a straight line, through a limited range of motion $F\ F_1$, and by placing parallelograms upon $A\ B$ and $B\ G$ other points such as $D$ can be found, which will copy the path of $F$.

The proportions and the ranges of motion can be determined as an application of the converse of a very simple geometrical proposition, but one not perhaps so well known as the last, viz., that if one point on a straight line be constrained to move in a straight line path, a second point on it will trace out the curve known as the conchoid of Nicomedes, if the line is made at all times to pass through a given fixed point or pole.

Thus, referring to Fig. 15, if the line $B\ H$ at all times passes through the point $G$, while $F$ moves in the vertical straight line $Y\ Y$, then the point $B$ traces out the curve $b\ b$. Conversely, if $B$ be made to move in the curve $b\ b$, then $F$ should move in the straight line $Y\ Y$.

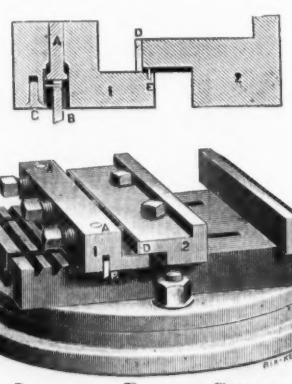
To apply this geometrical principle then it is only necessary to find $A$ the center of a circle, which approximates very closely to the conchoidal arc $b\ b$ between the required limits, and to construct the mechanism shown in the figure.

Let it be required then to design a conchoidal parallel motion, having two points moving with given strokes, say $S_1 = 1'\ 9''$, and $S_2 = 2'\ 8''$ respectively. Scale, $\frac{1}{16}$.

Draw a horizontal center line $X\ X$, and at right angles to it a line $Y\ Y$ intersecting $X\ X$ at $y$. Measure off above and below $X\ X$, $y\ F = y\ F_1 = \frac{1}{2}\ S_1$. Through $F$ draw $F\ H$ at $22\frac{1}{2}°$ to the horizontal, intersecting $X\ X$ at $G$. Produce $G\ F$ to $B$, making $F\ B = G\ F$. Join $G\ F_1$ and produce it to $B_1$, making $F_1\ B_1 = G\ F_1 = F\ B$. On $X\ X$ measure off $y\ b = F\ B = F_1\ B_1$. Find $A$ the center of a circle passing through $B\ b\ B_1$, and join $A\ B$. Draw a line $A\ K$ through $A$ and $F$, and on it determine a point $D$ such that $A\ D : A\ F :: S_2 : S_1$. Through $D$ draw $D\ E$ parallel to $A\ B$, meeting $G\ B$ at $E$, and $D\ C$ parallel to $G\ B$, meeting $A\ B$ produced at $C$. Then show that $F$ as a point on the slider crank $A\ B\ G$ and $D$ as a point on the parallelogram $B\ C\ D\ E$ placed upon it will describe approximate straight line paths $F\ F_1 = S_1$ and $D\ D_1 = S_2$ respectively, as was required.

## Jordan's Improved Planer Chuck.

We present herewith illustrations showing the construction of an improved planer chuck made by the Worcester Chuck Co., of Worcester, Mass. In this chuck the holding strip $B$ does not project from the end of the jaw, but is forced down into engagement with the base, by means of the pins $A\ A$, which slide freely in the jaw. Small pins are put through the strip $B$, which prevent it from moving endwise, and also from coming out, this latter being prevented by the pins coming into contact with the heads of the two screws $C$. The edge of jaw 2 is protected, where the set-screws come into contact with it, by a strip of steel $D$, this strip being arranged in connection with the small pins $E$, to prevent the jaws 1 and 2 from being separated. The vise is made either with swivel bottom (graduated), or



IMPROVED PLANER CHUCK.

without it, as may be desired, and is so arranged that no dirt or chips can get into the base. Set-screws and strip $D$ are of tool steel, other screws and nuts of machinery steel; wrenches, drop-forged.

The following statements are from the Secretary of the Interior of the Argentine Republic, which are dated May 1st, 1891: From January, 1890, till March 23d, 1891, the following new railways or sections have been opened for traffic: (1) Central Argentine branch from Cañada Gomez to Pergamino; (2) Buenos Ayres and Rosario prolongation from Pinto to Tucuman, besides branches to Santo Tome, etc.; (3) Northwest Argentine from Caseros to Mercedes, and from Corrientes to Saladas; (4) Southern of Santa Fé to Venado Tuerto and Carlota; (5) Bahia Blanca Northwestern to Bernasconi; (6) Transandine, from Mendoza to Uspallata; (7) Great Northern, from Salta to Santa Rosa. At the commencement of the year there were, according to the *Railroad and Engineering Journal*, thirty railways under construction or survey, with a total length of 7,800 miles, including four State railways, with a length of 440 miles, and twelve lines holding government guarantees, with a length of 4,030 miles, besides nineteen others. In 1889 there were 5,150 miles of railroad open for traffic, and in March, 1891, 7,310 miles.

The American Tube Works, of Boston, Mass., have recently made some brass tubes for Walter Durfee, of Providence, R. I., which are supposed to be the largest and heaviest tubes of brass ever made in this country. The largest of them is nine feet long, $4\frac{9}{16}''$ diameter and seven-eighth inch thick, weighing about 316 pounds. The tubes are used in place of bells for what are called tubular chimes, being far more efficient than bells, weight for weight, and producing a peculiarly sweet tone.

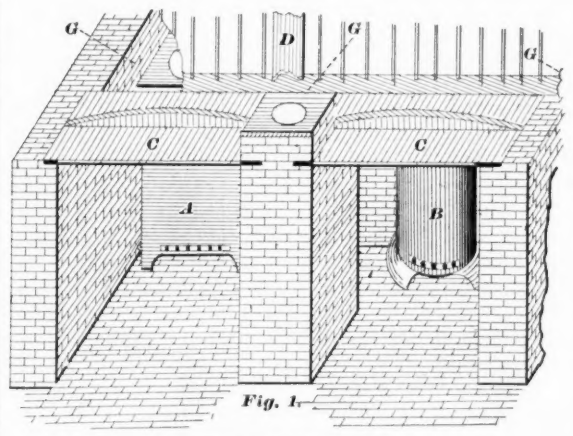



Fig. 1.

PRACTICAL BRASS FOUNDING.

## Practical Brass Founding.

BY ALEX. CAIRNS.

FIRST PAPER.

INTRODUCTION—FURNACE PITS.

Before presenting a few articles on the above-named subject to the readers of the AMERICAN MACHINIST, I wish to make a preliminary remark or two in regard to their scope.

The furnaces which will be shown—the round and square—are substantially the same as those met with in every-day practice, with a few slight improvements not worthy of special mention. They may be expected to give results equal to any coke furnace in use at the present time. But it will be evident to any one conversant with the principles of heat and draught that they are not constructed on thermo dynamical principles, and consequently the best results cannot be obtained from them. For this reason, then, I shall try, further along, to bring a few of the principles of thermodynamics to aid in building a furnace which ought to give results quite equal to the gas blast furnaces. The data given under the various heads are the results of experience and the conclusions I have drawn from them.

As the location of a brass furnace is one of the first things to be considered in building one, it will be found good practice to place them as near the wall as possible, at either the ends or sides, with a view to building the pits from the outside, as shown at Fig. 1. The present system of building small pits in front of a furnace, where they can get no draught other than from the top, is, to say the least, very bad practice, not to speak of the inconvenience experienced in not being able to take off the heats in a reasonable length of time.

At $A$ and $B$, Fig. 1, is shown the location of a square and a round furnace, with respect to their location in the pits, and the relation of the pits to the outside of the shop—the height of the furnaces above the floor of the pits depending, of course, on the level of the floor on the inside of the shop.

At $C\ C$ are shown two lintels on which the wall of the shop can be built of brick, but in the case of a frame shop they are not necessary. Their size will necessarily depend on the size of pits and furnaces, in which case they can be proportioned as is customary in such cases, according to the wall built on them. Intervening spaces, when they occur, as at $G\ G\ G$, should be covered with boards or iron plates; particularly should the latter be put in as a support for the flues running to the stack.

It will be seen from this arrangement that the furnaces get plenty of cold air for draught, and that little, if any, attention is required in the way of cleaning out, and, when the latter is necessary, being done outside, it does not interfere with work inside of the shop in any way, as is usually the case with furnace pits built on the inside of the shop.

Six men were recently convicted and fined in New York for forcing minors to work overtime in tenement houses. The convictions were brought about by the efforts of women inspectors.

## Largest Dry Dock on the Great Lakes.

On account of the demand of increased facilities, the Detroit Dry Dock Co., of the city of Detroit, Mich., decided to build a new dry dock, which is now about completed, and is claimed to be larger and finer than anything yet attempted on fresh water. The inside dimensions are: 378 feet long; 91 feet wide on top; 78 feet opening at entrance; 54 feet opening on miter sill; 55 feet wide on floor; 16 feet 6 inches of water over keel blocks; 16 feet 6 inches of water over sill; 4 feet 6 inches from top of keel blocks to floor of dock; 20 feet 6 inches from water line to floor of dock. The keel and bilge blocks are five feet from center to center, averaging five feet high, thus leaving plenty of room under a ship for the movements of workmen in making any necessary repairs. There are two wells 12 feet deep, situated at each end of the dock, with cranes above them for hoisting out and replacing wheels, etc. The caisson gate, constructed at the company's steel shipbuilding plant at Wyandotte, Mich., is 12 feet beam, 79 feet 5 inches long, with five 30-inch valves for flooding the dock, which, it is estimated, it will do in twenty minutes. Time required to pump the dock out is $1\frac{1}{2}$ hours. The whole dock is surrounded with a puddling wall filled with blue clay five feet thick, and extending down below the old river bed, which shuts off all water from leaking through the sides.

The pumping plant consists of two centrifugal pumps, with 30 inches discharge each. These are driven by two 150 H. P. independent compound Westinghouse engines. These pumps are in a well 22x11 feet inside, and 35 feet deep, the water passing from the dock to the well through a brick tunnel $5\frac{1}{2}$ feet diameter and 55 feet long. The steam for the engines is supplied by a battery of three boilers $5\frac{1}{2}$ feet in diameter and 15 feet 6 inches long, built by the Dry Dock Engine Works. The fuel is oil, and the whole pumping plant is housed in a two-story brick building, 34x81 feet. A dynamo-room is provided, where an electric light plant will be put in during the coming winter, which will supply the entire shipbuilding plant with light. The second floor of the building will be utilized by the workmen at noon and other hours, when work may be temporarily suspended.

This dock is large enough to take in any boat now upon the lakes, and has been designed especially for the wide railway car ferries, and passenger boats with their over-

hanging guards and paddle-wheels. Nearly a year was spent in its construction, and its cost is about $200,000.

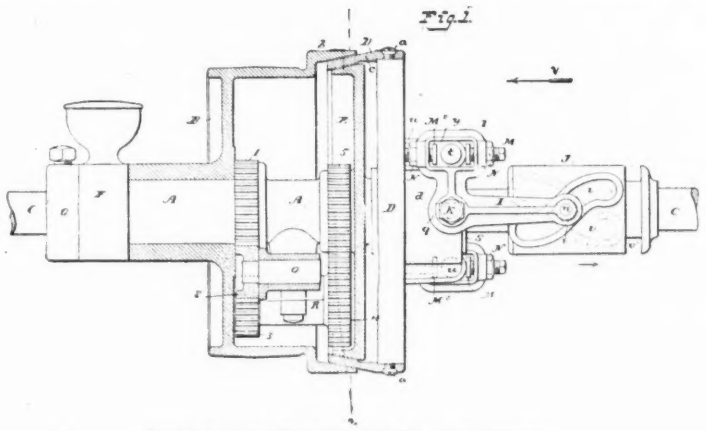
This company has also added to its plant a pair of steel shear legs, for hoisting boilers, engines, etc. They are 100 feet high, and have a lifting capacity of 100 tons.

Notwithstanding the novelties of the gift enterprise press of America, the English newspaper men have stolen a march upon them that is calculated to make them howl with anguish. The London *News and Post*, staid and conservative to a fault, now prints its news in scented ink. There is only one thing to be done now. Some "leading daily" on this side of the Atlantic must advertise that it will give customers their morning paper in any perfume they may choose, whether "white lilac," "stephanotis" or "Nile lily."—*Sunday Mercury.*

## A Single-belt Reversing Countershaft.

We illustrate herewith a device for driving countershafts or other machinery in reverse directions by the use of only one belt. At Fig. 1 we show a vertical section of the device, *C* being the shaft, and *B* the pulley upon which the belt runs, this pulley being loose on the shaft. The pulley has at the right a flange or enlargement, the inside of which is tapered to the proper angle to form with the ring *D* a friction clutch, which can be operated in the ordinary manner by the shifting lever, and causes the shaft to rotate in the same direction as the pulley. The pulley *B* does not have its bearing directly on the shaft, but on a sleeve *A*, which is also loose on the shaft and passes through the hub of the pulley, outside of which it carries an arm *F*, which rests upon some fixed support, so that the sleeve *A* is prevented from turning, and always remains stationary. Inside the pulley *B* there is fixed a gear wheel 1, which is fast to the pulley, and by means of an intermediate gear on the stud *O*, drives the gear 3, this gear being keyed to a shaft, which passes through *R* and carries at its other end the gear 4, which in turn drives gear 5, this gear being keyed to the friction disk *E*. The stud *O* and the bearing *R* are supported from the sleeve *A*, and are thus made stationary. The result of this arrangement is that disk *E* revolves at all times in the opposite direction to that of the pulley *B*, and the friction ring *D*, which is attached to the disk *D*, can, by being moved lengthwise on the shaft, be made to engage with either of them. The gears, it will be noticed, are entirely enclosed and covered up.

Fig. 1.



SINGLE-BELT REVERSING COUNTERSHAFT.

The disk *D* is moved forward and back to engage with either friction by the device shown at the right, which consists of two bell cranks pivoted on studs *K*, which pass through a collar on the shaft and engage with the shaft itself, the hub of the disk *D* sliding on this collar, slots being provided in the hub for passing over the studs *K*. The levers are reversed with respect to each other as shown, and are moved by means of the double cam seen at the right, which is operated by the shifting lever. The studs *t* are fast to the hub of *D*, and are engaged by the ends of the adjustable screws *M*.

The device is intended also to be applicable to tapping attachments for drill presses or other machines, and has been patented by Mr. Everett C. Lewis, Woonsocket, R. I.

The Executive Council of the British Shipping Federation has adopted a plan for insuring the lives of men serving in Federation ships. The plan provides for weekly payment to men in case of injury, or in a gross payment to the relative indicated, in the case of death. The Federation distinctly disavows any intention of philanthropy, but believes that by the proposed plan the services of better men will be secured.

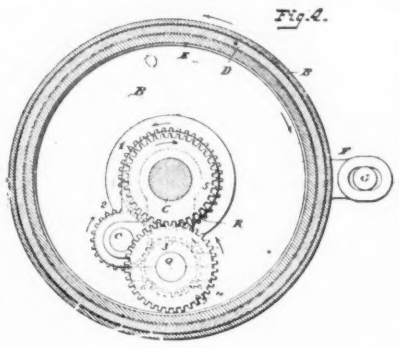
## The Leader Brick Machine.

We illustrate on this page a modern brick-making machine known as the "Leader," which, though simple, and occupying comparatively little space, is capable of making 25,000 bricks per day of ten hours.

Clay which has been previously tempered is fed to the hopper, which is supplied with a roller that forces it downward into the machine, it being found that this roller increases the capacity of the machine by about 50 per cent.

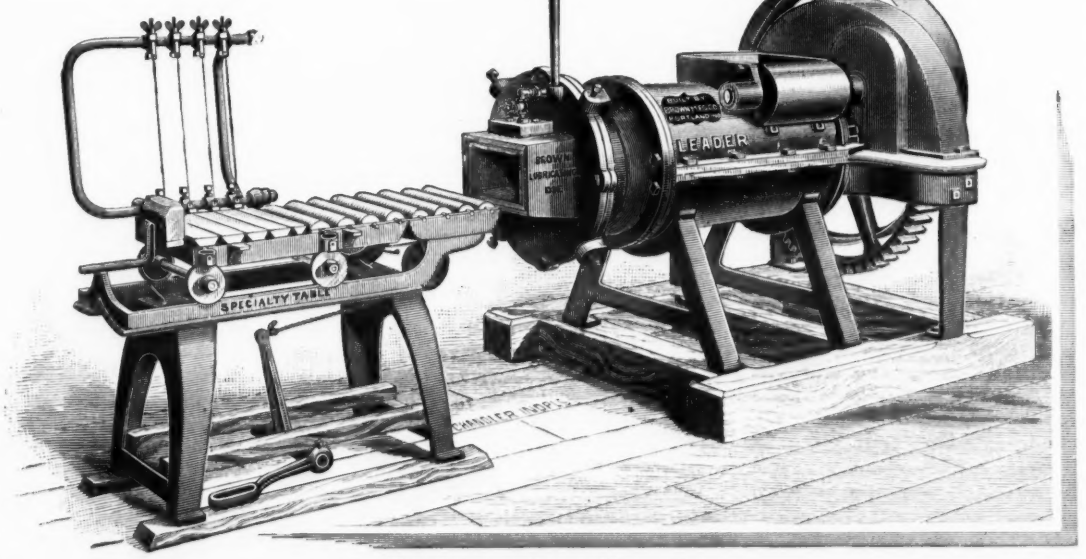
Below the hopper it is engaged by a spiral conveyer called an auger, which forces it forward through a die of suitable form, *i. e.*, to suit the cross section of the brick to be made. This die is lubricated by steam, which is introduced through perforations in the sides, more of these being placed at the corners than elsewhere, so that the friction is made practically equal over the entire surface, making a brick of uniform density, free from tendency to warp in burning, and which may be chipped or split the same as a hand made brick, the corners being sharp and true.

Fig. 4.



Various cutting tables are made to be used with the machine, the one shown being intended for first-class front brick.

The cutting device is shown hinged at the back. It is arranged to cut four bricks at a time, and these are removed before raising the cutting wires, thus leaving the bricks clean and free from chips.




THE LEADER BRICK MACHINE.

The machine is built by the Decatur Leader Mfg. Co., Decatur, Ill.

The American consul at Guatemala gives some wholesome advice to would-be exporters in this country. He tells them, in effect, that they do not take proper means to let it be known what they have to sell, that they ignore the prejudices of the people as to what they want, and that they fail to properly pack the goods sold. So long as our exporters fail to study the exact needs of foreign customers they will reap little benefit from "reciprocity."

## Sunday Labor.

"It will be a curious incidental result of the improved scale of pay for letter-carriers," says the *Pall Mall Gazette*, "if the better pay leads to an increase of Sunday labor. But that seems to be by no means improbable. And for this reason: Hitherto the letter-carriers in districts where there is a Sunday delivery have received no extra pay for their Sunday work, and have had a holiday only on alternate Sundays. Under the improved scale that has recently come into force, all Sunday labor is to be paid for, and at a higher rate than week-day labor. The good-natured public will consequently now be pulled in two directions, for many a postman would be glad to earn an extra four shillings a fortnight by working on alternate Sundays. For the same reason, the people who want the convenience of Sunday deliveries will now be able to pose as the friends of the 'poor postman.' It is probable that this consideration will just turn the balance in many districts, and, instead of petitions for the suppression of Sunday labor in the post-office, there may be a general move in favor of the re-establishment of Sunday deliveries."

The particular goal towards which the shops of the Samuel L. Moore & Sons Company are now bending all their energies, is the completion of the United States practice cruiser within the time specified by the contract. There is at present every prospect of being able to do this, and if done, it will be the first vessel of the new navy to be finished within the specified time. It will be remembered that this company built the hull of the Pennsylvania Company's new steel double-screw ferryboat "Cincinnati," and this was completed and delivered one week ahead of the time required by the contract. A letter received by the company recently from Mr. Ely, after expressing the satisfaction of the Pennsylvania Company with the vessel, mentions particularly this fact of prompt delivery, and says that it is quite without precedent in the history of the road.

The Chicago & Southeastern Railroad Company has filed articles of incorporation with the Secretary of State. The line of the road to be constructed begins at the eastern terminus of the Toledo, Peoria & Western Railroad, on the west boundary of the State, in Newton County, and will run southeast to a point on the eastern boundary near Bethel. A line will also be constructed from a junction point in Parke County south to Brazil, to reach the coal fields. These lines will traverse the counties of Newton, Benton, Warren, Vermillion, Fountain, Parke, Clay, Montgomery, Boone, Hamilton, Madison, Delaware, Randolph and Wayne. The total length of the road is 230 miles. The following is the board of directors: Charles S. Harris, L. G. English, E. A. White and S. R. Krofut, of Chicago; and Edward R. Colbrook, of Brooklyn.

A Chicago dispatch says:

"The writing telegraph instrument was exhibited at the North American Telegraph Company's rooms, in this city yesterday. The test was between Chicago and St. Paul, more than four hundred miles, and despite unfavorable weather, the result was successful. The instrument is very simple. The only thing visible is a roll of tape, the same as used in tickers. The operator takes a pencil, and placing the point on the sensitive plate in the opening, simply writes his message, and at the receiving point it is duplicated on the tape. In this manner pictures can be traced, maps drawn, and notes signed at the distance of thousands of miles. Experts claim it will do away with the Morse system, and can be worked at a rate of forty-five words a minute.

The system of appointing men as foremen of the various departments in the navy yards by competitive examination is undoubtedly a good ways ahead of the previous system, in which political proficiency controlled the appointments. But this system (competitive examination) is so far behind a common-sense system as to make an American blush for its necessity. Imagine, let us say, Mr. Smith, wanting a foreman for his machine shop, and setting up a lot of applicants, his decision as to which he should take being governed by answers to questions put to them by men neither of whom could properly take charge of his work. Still, as we have previously said, the present system has its advantages as compared with the old one, for which the present authorities should be thanked.

From all over the world there comes the trouble of the want of sufficient water supply of a good quality. To obtain such a supply in large cities all over the world has become one of the hardest problems of the day. It is more than probable that condensation will yet have to be resorted to in the case of some large cities, poorly situated as to water supply. As countries get more and more densely populated, streams that are the source of water supply become worse and worse contaminated. Filtration, for the present, offers about the only means of securing decent water in many cities in this country, and doubtless will be largely resorted to in the future.

It is stated that the Japanese Government purposes spending the sum of £140,000 in connection with the World's Fair at Chicago, of which it is expected £30,000 will be for Government exhibits alone.

## LETTERS FROM PRACTICAL MEN.

### A Tool to Crown Pulleys.

*Editor American Machinist:*

Crowned pulleys are as yet a necessary evil. No belt can run at one velocity on its edges, and at another velocity in the middle. Therefore the working contact of a belt on a crowned pulley is probably more limited than at first seems likely. Frustum crowned pulleys are most common, and they are very bad. No belt can, or rather does, take an angular shape to fit a frustum pulley, and, if it did, a belt on such a pulley either must pull on the top of the "crown" and slip elsewhere, or it must pull elsewhere and slip on the top of the crown. Therefore a crowned pulley of any shape should be as little crowned as is necessary to guide it.

In considering the question, some years ago, of a means to economically and practically crown pulleys so that they should have curved faces, and so that the faces of different pulleys might readily have various curves across the rim, I came to the conclusion that the plan suggested in this sketch would be a very expeditious and practical method of milling crowned pulleys of various curves.

The section *A* is of a pulley which is assumed to be mounted on the revolving table of a horizontal pulley machine. The rim of this pulley should be supported directly under it and between it and a secure part of the revolving table. There should be clamps upon this rim directly over these supports, and they, in turn, should be bolted to this table also. Inasmuch as this pulley would be machined complete on its face in one revolution of the machine table, the rotation of that table must be quite slow—much slower than when turning with a single-pointed tool. The direction of rotation in the pulley in operation is indicated by the arrow on the arm, and the direction toward the center of the pulley is indicated by the radius *L*.

The cutter head *B*, mounted on the spindle *I*, is provided in this case with eight cutters; it should have in practice as many as it is practicable to put in. A means of securing these cutters to the head *B* is shown, as well as its manner of being held to the spindle. The center *M* of the spindle *I* is, of course, the center of the cutter head, and the distance from the center *M* to the radius *L* determines the amount of crown of the pulley. If the center *M* should be exactly opposite the center of the pulley *A* then the cutters *C* would make the face of the pulley *A* spherical. If again the cutter *C'* at its point should cross the line *L* in the middle of the rim, then that rim would be cut approximately cylindrical. The crown on the pulley will be high as the center *M* comes near the line *L*, and low as it recedes from it. If the cutter *C'* should be placed between the center *M* and the radius *L*, then this device would make a concave, and not a crown faced pulley.

The spindle *I* is mounted in the stock *D*, which must have an adjustment as indicated by the arrow *J*, an adjustment as the arrow *K*, and also a vertical adjustment. These three adjustments would locate the stock *D* anywhere as desired. The spindle *I* is driven by the worm-wheel *G*, which may be secured to it as shown, or otherwise. This worm-wheel is driven by the pulley *H* through the shaft *E*, and through a worm on the shaft *E*. This worm is shown dotted, and a part of its hub is shown, marked *F*.

That this device would be practical is evidenced by the success this particular form of milling has attained. I believe that it is conceded that stock is removed by tools of this character more economically than by any other.

If one of the cutters *C* be set a trifle nearer the center of the head than the others, so that it will pass over the surface already finished, and then, if it be pointed like a V thread tool, with a rounded point, and adjusted so that it will cut deeper than the other tools, there will be provided an exit for air, and the problem of air cushions would be solved without cost.

The diameter from *C* to *C* on the head *B* should greatly exceed the width of the face of any pulley to be made. I would suggest that it be double in diameter the width of the face of a medium pulley.

A. D. PENTZ.

### Proportion in Steam Engines.

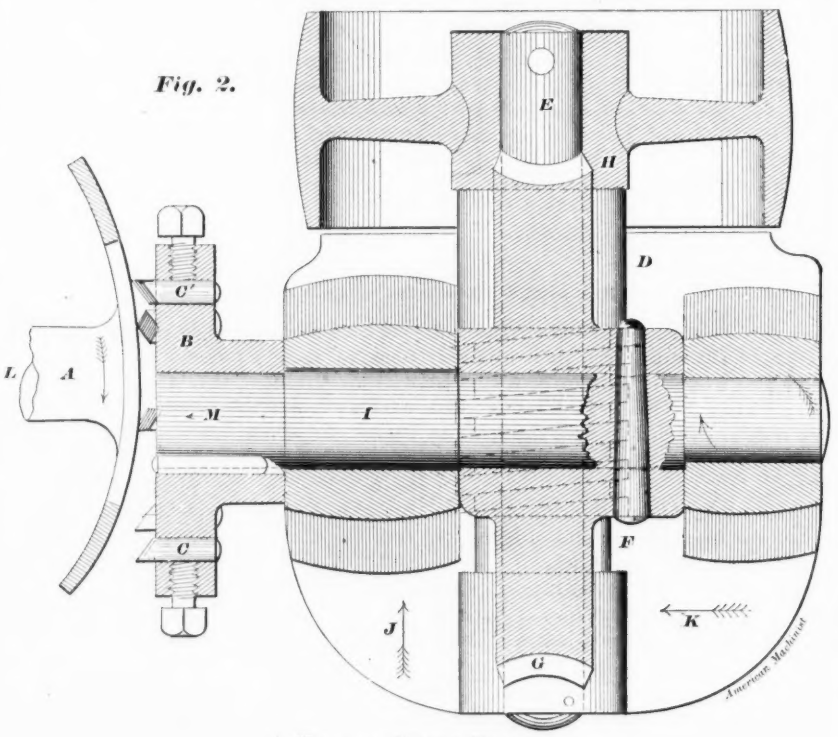
*Editor American Machinist:*

Thus far, the best method found in applying steam pressure as power in producing rotating motion, is that of cylinder, piston, connecting rod and crank; what else may occur in that line is unknown until it does occur.

The past experience in the use of steam has very many lessons of practical utility for the mechanical world at this present time. Very much has occurred in modification of the cylinder crank engine since it was at first devised; yet the principles of the first engine are found in the present steam engine, now improved so as to get the best and most economy, considering the cost of engine, and the amount of fuel it will use, to produce given results.

In former years the inclination of builders and designers was to construct engines with cylinders of small diameter, and piston and crank having long stroke, oftentimes of a proportion of 3 to 1; for example, cylinder, 10″ diameter; piston, 30″ stroke; crank, 15″ long; and with some show of reason to do so, designers reasoned that a long crank

*Fig. 2.*




A TOOL TO CROWN PULLEYS.

is like a long lever, and long levers have more power to move objects than short ones do; certainly, that is a law in mechanics; but other conditions limit the length of the crank and stroke of the piston in relation to a correct diameter of the cylinder, so that another law, that of a larger area of piston under the same pressure, will produce more power upon the same crank than the smaller one will, must be observed.

Now in the construction and use of the steam engine in the past, as the requirements of it became more and more exacting, the efforts of builders have been, of course, to meet every demand so that the once long stroke engine, with cylinder of small diameter, has been modified to that of a very much larger cylinder diameter in proportion to length of the stroke, until in many cases the diameter of the cylinder equals the length of stroke, and in some cases exceeds it with good results.

In earlier years of my experience as a machinist, I chanced for about eight years to work on locomotives, where I had an excellent opportunity to observe and learn some facts.

A certain railroad that built many of its engines then, built a freight engine having cylinders 16″ diameter; piston, 26″ stroke, using a 13″ crank on a 60″ driving wheel; this was considered by the master mechanic as a good proportion of the mechanism, and those locomotives did good service, and would draw a certain number of loaded cars equal a certain number of tons up a 60-foot to the mile grade; but traffic grew heavier, especially the passenger trains, or some of them, which necessity brought about the construction of an engine of different proportions built for passenger train service, having cylinders 18″ diameter; piston, 22″ stroke; crank, 11″, and driving wheel about 68″ diameter.

When the trial trips occurred (freight service) it was found that the last constructed engine would draw at least one fourth more burden up the aforesaid grade than the regular 16″x26″ freight engine would, and both engines were of about equal weight on the driving wheels. This proved the wisdom of constructing an engine where more power was needed, with cylinders of larger diameter in proportion to length of stroke, so that the large stroke freight was supplanted by one of shorter stroke with larger cylinder, with good results therefrom—until now an engine with cylinders 20″ diameter; stroke, 24″, having driving wheels of about 50″ diameter, draws more than twice the load up the same grade than the former freight engine did. Of course the present freight engine is very much heavier than the former one was.

You will note that the proportion of diameter of cylinder, and length of stroke of the engines of the present fast-running steamers that have crossed the Atlantic the last few years, far exceeding all previous time for speed, are not far from the proportion of the diameter of cylinder equaling the length of stroke, and exceeding it in the second and third cylinders.

I am of an opinion that an express locomotive built, having cylinders 22″ diameter, with not over 19″ stroke on a 60-inch wheel, would utilize steam power very much better than the present express engines do; certainly the speed of piston per minute would be lessened. If I were a master mechanic of a railway which required engines of increased power and speed, I would replace the cylinders of a now 40-ton engine with cylinders 22″ diameter, with 18″ stroke of piston, on about 56″ wheels. This may seem a little extraordinary or excessive to some, but, friends, the mechanical and steam world are plunging in that direction.

One difficulty experienced by those building quick-running engines (stationary engines) has been in that they have not shortened the stroke and enlarged their cylinders enough, in comparison, to slow speed engines. My opinion is of fast locomotives that either the stroke of piston must be lessened, the diameter of cylinder enlarged, and the size of wheel somewhat reduced, or else the fond anticipation of quicker speed must be abandoned; steam will do work easily inside of the law of correct proportion in the engine that uses it.

The speed of piston per minute in an engine 18″x24″ with 70″ wheel, when running one mile per minute, is not far from 1,200 feet; put the same engine on 56″ driving wheels, with cylinders 22″x18″, and we have a speed of piston about 1,080 feet per minute when running at the speed of one mile per minute.

The piston area of the 18″ cylinder is not far from 280 square inches, that under a steam pressure of 150 pounds per inch equal 32,000 pounds pressure at full stroke, or before cut-off takes place. The piston area of the 22″ cylinder is not far from 380 square inches, and under the same 150 pounds pressure equal 42,000 pounds pressure, or about one-quarter more than the former, but on a shorter crank and smaller wheel, and every railway engineer knows that the large driving wheel does not draw a load so well, easy and fast as the more moderate size.

I am advocating correct proportions, and believe the present engine is yet some out of proper proportion for utility and speed. Certainly the task of properly balancing connecting rods on the shorter stroke is easier than that of the longer stroke.

Other items, of course, enter into the theory of the best working engines, but the lessons already learned prove that quick-running engines must have large piston area, short crank and smaller driving wheels, and, if stationary engines, small pulleys.

F. W. CLOUGH.

### Oversize Taps—Arbors—Straightening Hardened Steel.

*Editor American Machinist:*

The article in issue of Sept. 17, 1891, by W. L. Cheney, entitled "Oversize Taps," opens up a very interesting topic, viz., the proper method of making taps, as well as a proper system of threaded holes to secure a good fit for the much-abused screw, to obtain the result desired for so-called United States Standard threads, which are flat top and bottom $\frac{1}{8}$ of the pitch, use a thread tool one pitch finer than the thread to be cut; if to cut eight threads to one inch, by using a nine-pitch tool you get a slight clearance that will answer all practical purposes, and secure what the system aims at—a stronger thread than the sharp V.

Measuring the outside diameter to get the correct size of a thread is a little out of date since the advent of the thread micrometer caliper made by the Brown & Sharpe Manufacturing Company, which gives the exact size of the thread half way from the outside diameter to the bottom of thread on each side, or, in other words, from the bottom of one thread to the top of the one diametrically opposite, without regard to the diameter across the top of the threads; by adding to this measurement the full depth of one thread you have the actual size of the thread.

To ascertain the full depth of one thread—the figures required to add to the reading of the thread micrometer—divide .866, which is the sine of 60°, the angle of the thread, by the pitch. This is correct for sharp V thread, but as the so-called United States Standard thread is only $\frac{3}{4}$ the depth of the sharp V thread, divide .6495, which is $\frac{3}{4}$ of .866, by the pitch, and subtract the remainder from the outside diameter of the thread, which will give the correct figures to set the thread micrometer to, in cutting thread to standard size for United States Standard thread.

I doubt the advisability of making taps so they will cut in the bottom of thread, as advised by Mr. Cheney, as they are liable to tear and make a rough threaded hole, when a good result may be obtained by having proper size tap drills.

In making arbors I use tool steel, hardened and ground .006 taper per foot, leaving $\frac{1}{64}$″ to grind; with this amount of stock left for grinding, I generally find straightening necessary after hardening, which can be done by heating under pressure, being careful not to heat to a point where the temper is drawn, and as it is asserted by men of practical experience that there is a degree of heat before reaching that point at which a hardened piece can be bent and set,

if cooled off while still under pressure, it would be an interesting problem to find out just where that point is, and if it varies, as I think it does, under different conditions of stock and temper.

I find it a very safe rule to cool off when the heat of the piece reaches a point to melt soft solder. This manner of straightening will apply to drills, reamers, etc.; in fact, to any tool that requires to be ground after hardening, but in the case of tools that are to be tempered after hardening, the straightening should be done before the temper is drawn, as the tempering gives an elasticity to the steel, and makes it very difficult to straighten with any degree of heat which would be safe to apply.

For straightening small pieces, the ordinary bench vise, with three pieces of brass rod bent to hang on the jaws, will answer, but for the larger pieces a bench press, conveniently arranged so as to apply a gas heater to the work when in the press, is an indispensable article. TOOL-ROOM.

### Rusting of Grindstones.

*Editor American Machinist:*

A recent correspondent of the AMERICAN MACHINIST who is troubled with the rusting up or smoothing of his grindstone should seek the cause in the texture of the stone. Very probably he may find that the stone is one of those which is of firm texture, that is, in which the grinding particles are cemented so firmly together that they become smooth before they break out of their setting. Were it possible to increase the hardness of the cutting particles it is probable that they would remain sharp for so long that they would be torn out of the matrix before they ceased to be effective cutters. A grindstone therefore glazes when the firmness of its texture, *i. e.*, the cohesion of its particles, exceeds their hardness. It wears away too fast, on the other hand, when the particles are torn away before being sufficiently smoothed down by wear, and, of course, that stone is best which has the best balance between these two qualities.

As already explained, a grindstone is kept true by cutting notches on those parts of the surface which begin to project; the notches increasing the cutting action because they render the surface discontinuous, and promote wear. Probably your correspondent could cause the stone to take hold, if he would hack it all over to a depth of a sixteenth, for this would promote change of the surface, and bring about in working a continuous break of surface, every notch being like the tooth of a saw or milling cutter. If a little occasional treatment of this kind does not mend matters the stone is probably too expensive, and should make room for one which will cost less in attention.

Sometimes the trouble with a glazing grindstone is that the cutting particles are too small, and are therefore less easily broken out of their setting than they would be if of larger size. Of course this is merely a repetition of the fault above named, but will suffice to show that the trouble may be variously caused. A coarse-gritted stone usually termed soft may in reality be very much harder than a stone which glazes, although the coarse stone may be so easily crumbled. It crumbles, however, into grit, not into loamy sand.

There are stones of fine texture which are soft all round; they wear quickly, and yet cut poorly, because their particles are not hard or angular, nor are they well cemented together. Such a quality is only suitable for soft objects, which would fill the pores of a hard stone, and their use must be very limited.

In England the grit stones of the carboniferous rocks seem to be the source of all grindstones, though there are some beds of this rock, which, even if of a suitable texture, have the inseparable objection that they contain pebbles of quartzite, thus rendering the stone useless for grinding purposes.

The moorlands of England consist almost wholly of such rocks, either outcropping by virtue of geological upheaval or left bare by their superior resistance to denuding action.

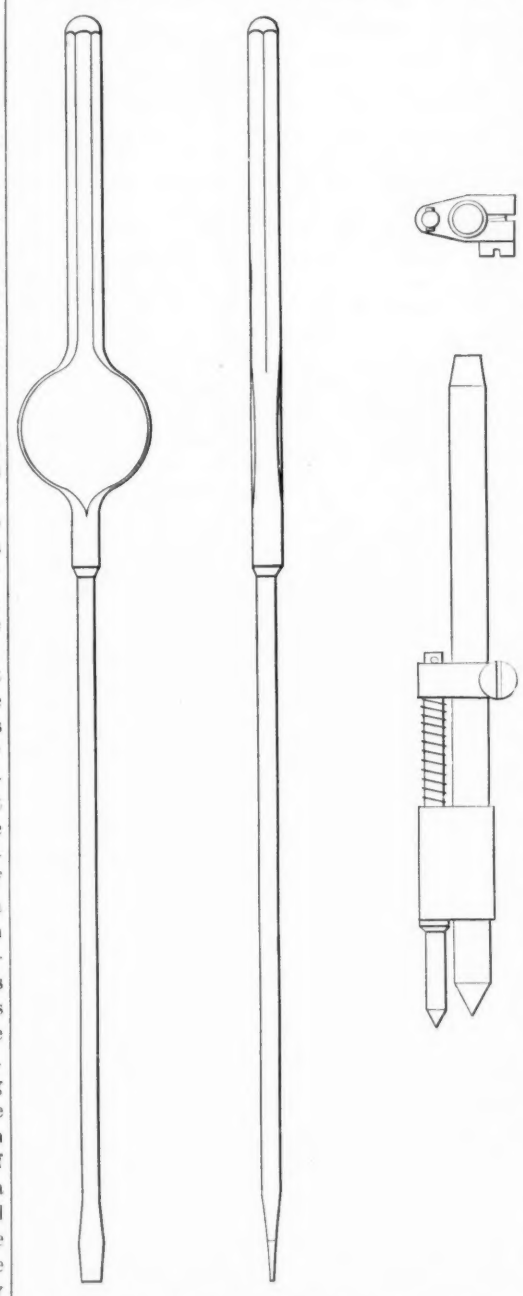
It is not, however, from these sources that the useful stone is obtained, the source being more frequently a quarry at a lower level. Large numbers of grindstones are quarried thus in the county of Derbyshire, near Rowsley and Stanton. Geologically, the millstone grit comes beneath the coal seams, though it often does contain thin seams of little value. This deposit seems, however, to be almost peculiar to England.

Berea, in Ohio, appears to be the chief American source of grindstones, but to what special formation the rock belongs I have no information.

It has been brought to my notice that tallow has been tried in place of water for the grinding of fine cutlery, and with advantage; but this information was published over fifty years ago, and I have no information as to its use at present.

The use of grease appears, however, as rational as the use of oil on whetstones.

Some one may perhaps try the plan, or has already done so. W. H. BOOTH.



**Double Center Punch—Small Screw-driver.**

*Editor American Machinist:*

Those of your readers who have much irregular shaped work to get out of sheet metal by drilling a series of holes around the required outline may be interested in a center punch that I use in laying out work of that nature. As shown by the sketch, there is a small rod that is used as a guide by placing it in the last mark made. This insures the center punch marks being equally spaced without very much waste of time on the part of the operator, and no cold chisel work has to be done, except perhaps at the edge of the sheet. The upper piece is a loose fit on the guide, and is clamped to the main punch at such a height as to permit the guide punch to be slightly the lower when in its normal position. The lower piece is a close sliding fit on the main punch, and an easy driving fit on the guide.

It can be made somewhat simpler than shown, by omitting the clamp and holding the guide punch down on the work by the fingers instead of the spiral spring, but in that form it is not quite so convenient. When necessary to grind the main punch, it may be removed from the rest of the rig by loosening the clamp screw, but care must be taken to grind the point true with the body of the punch, if the original spacing is to be maintained. Nearly everybody I show this to asks why I didn't make it adjustable. I fail to see the necessity for this in drilling out irregular shapes, as in this class of work we are generally free to use any sized drill we choose, and we might just as well choose one to suit the punch as to make the punch adjustable, in order that it may suit some drill selected at random. Two or three of these rigs for different spacings would, I think, cover all the requirements of an ordinary shop. For drilling out a slot, it might be well to have it adjustable, and one way of doing this would be to grind the point of the main punch eccentrically, and set it around in the clamp according to the requirements. Another way would be to have the point of the guide punch eccentric, and have it a loose fit in the lower piece, with a set-screw to hold it where desired. Or, by having both points eccentric, a greater range of adjustment would be obtained.



I find that a very good way of drilling a series of holes is to drill every other hole, and then go back and drill the holes that were skipped on the first trip over the work. This counteracts, in a measure, the tendency of the drill to go where you don't want it to especially if the drill is a trifle larger than the distance between the two points of the punch.

The screw-driver shown herewith is one that I find very handy in putting together or taking apart small pieces of work—for screws ¼" diameter or less. It is somewhat on the order of the watchmakers' screw-driver, but with this difference—the watchmakers' screw-driver is usually of a uniform diameter where the fingers grasp it, but I made mine with a hexagonal part of quite small diameter for use in running the screws in quickly, and a disk-shaped part of comparatively large diameter, by which to give them the final twist home. The handle part is made of hard brass, and the blade of drill rod soldered in. The disk-shaped part prevents it from rolling around when laid down on a surface that is not exactly level, and very often this is quite an item.

WALTER GRIBBEN.

### Seeks Information.

*Editor American Machinist:*

In making out a bill to customer for machine work done at night is it customary to charge the extra time allowed a man the same rates as for regular time, or to charge your customer just the amount of his wages? To illustrate:

| | |
|---|---|
| 10 hours night work at 50c. per hour | $5 00 |
| 5 hours extra time allowed at 25c. per hour | 1.25 |
| | $6.25 |

Or:

| | |
|---|---|
| 10 hours night work at 50c. per hour | $5 00 |
| 5 hours extra time allowed at 50c. per hour | 2.50 |
| | $7.50 |

The rate 25 cents per hour is the wages paid the machinist. Is it customary to make an extra charge for running the engine at night? What is the average cost per unit for running a machine shop? If you will kindly answer me the above you will greatly oblige. F. HALSEY.

In our issue of Oct. 15 we illustrated and described "Electric Motor Gearing," patented by Leonard Atwood. We are requested to state that the address of the patentee is P. O. Box 1827, Bridgeport, Conn.

### A New Engineering Laboratory.

*(Communicated.)*

Purdue University at Lafayette, Indiana, has just completed a laboratory for advanced work in mechanical engineering. The main building is 50x110 feet with monitor ceiling 40 feet from the floor. The boiler room connected is 25x40 feet. The equipment already on the ground includes a hundred horse-power Babcock & Wilcox boiler; a Harris-Corliss triple-expansion condensing engine having cylinders 8, 15 and 22 in. diameter by 24 inches stroke, and arranged to give every facility for careful work in testing under a wide range of conditions; an 85,000 pound Schenectady locomotive equipped with the Westinghouse system of automatic brakes. The locomotive is mounted upon supporting wheels carried by shafts running in fixed bearings, in such a way as to allow its action to be studied and its performance tested while the engine is running under any load at any desired speed. The power of the engine is absorbed by Alden friction brakes of special design, and its tractive force is measured by a dynamometer connected with the draw-bar. A Sturtevant steam blower mounted above the stack, but not in pipe connection with it, takes up and carries off whatever may come out of the locomotive stack. These larger machines are thoroughly equipped with all accessory apparatus.

There is an experimental stand-pipe in which may be maintained any desired head for hydraulic experiments, and in connection therewith are high-level and low-level tanks with weir plates between. There are two large Morris centrifugal pumps and a No. 5 Dean steam pump; several injectors; a thirteen-inch Leffel water wheel; several sets of weighing tanks, besides much smaller apparatus for this line of work. There is, also, a 100,000 pound Olsen testing machine for determining the strength of materials; a 2,000-pound Olsen cement tester; a 10 horse-power transmitting dynamometer; a 50 horse-power Alden friction brake, and a large amount of small miscellaneous apparatus.

The equipment of the new building, added to the extensive outfit of tools and machinery belonging to the department of practical mechanics, enables Purdue to offer large facilities to students in mechanical engineering.

### Coal Burnt on the Atlantic Steamers.

The steamship "Majestic," on her first record passage, is said to have maintained a speed of 20.1 knots, and burning 220 tons of coal each day; her engines indicated 19,500 horse-power. The "City of Paris" is accredited with 260 tons of coal during her voyages which she is at present making, and her average speed is said to be about 19¼ knots; but her indicated horse-power is less than that of the "Majestic." Reckoning 2,240 pounds per ton, the coal consumption of the "Majestic," according to the foregoing figures, is 1.05 pounds per indicated horse-power, which shows a remarkable economy of fuel; in fact, these figures would seem to indicate that there is a mistake somewhere. It is claimed that during a recent voyage the coal consumption of the "City of Paris" was only 240 tons per day for both main engines and all auxiliary power. But her total horse-power and the necessary deduction for the auxiliary power is not given.

### Erratum.

Mr. John C. Trautwine, Jr., 3301 Haverford street, Philadelphia, has published a little slip noting a mistake that appears in Trautwine's Civil Engineers' Pocket-book. It will undoubtedly be in the interest of engineers to secure this note.

It is reported that the output of sorghum sugar in Kansas and beet sugar in Nebraska, Utah, and California for the present season will reach fully 27,000,000 pounds.

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## Stationary Engineers.

Just now is the time of year when associations of stationary engineers should begin their winter's work in earnest. These associations base their usefulness mainly upon being educational factors, and the long, cool evenings now ensuing should, and undoubtedly will, prove an incentive to activity.

The art of stationary engine running is, it is true, one that cannot be learned otherwise than by actual practice, but such schools as the numerous societies of stationary engineers can organize may be a wonderful help in perfecting the members in the art. When, for example, fifty working engineers meet together at stated intervals, their collective information represents a vast amount of knowledge. Nearly every one of them has solved some problem in the line of his work that the others have not solved, and the point should be to bring this out for the benefit of all.

Too much dependence is placed, in engineers' societies as in all other similar societies, on eminent lecturers. Lectures by such men should by no means be despised. On the contrary, the services of men competent to give information should always be obtained when at all practicable. But this should not be the entire or the principal aim of engineers' associations. Their meetings should be so conducted as to bring out, from time to time, the combined knowledge of the membership on the diverse points connected with the business of competently managing a steam plant.

The number of stationary engineers in this country is not known, but it is many thousands. Steam has grown so rapidly into use that those who manage its use have come to be a large army. And just as in every branch of business the supply meets the demand—meets it frequently in a way just about as a machine shop or a foundry could be filled with laborers—so the demand for engineers is met. But this is not the way the demand for engineers should be met. Not only for economical reasons, but for reasons of safety, good men—men who have made a study of their business—are required.

A good deal of harm has been done the steam engineers by the builders of engines who have made a point of advertising that their engines did not require an engineer to operate them. No steam engine can be properly operated without the services of an engineer. The assumption that a steam engine doctor can come around once in a while and make everything right is fallacious. The engineer must be the doctor, with his finger always on the pulse of his patient.

There is no school, properly speaking, for stationary engineers. If there were such a school it could no more make a stationary engineer than a law college could make a competent lawyer, or a medical college a doctor. Either one of the institutions named can grant a diploma, but so far as competency is concerned it amounts to very little. Men employ the lawyer who manages their cases well, or the doctor who prescribes the right medicine for the case in hand. Lawyers and doctors alike learn by experience—by their own experience, and by the experience of others. All learn largely by the experience of others. And this should be the case with stationary engineers. They should patronize the meetings of their associations, giving and receiving information.

It is astonishing how much may be accomplished in this way. As an example, the writer recently had the pleasure of attending a meeting of stationary engineers at which a member brought up a case of some trouble in steam heating in a large building. And he does not hesitate to say that the information volunteered by the members present was more comprehensive in its scope than that which could be obtained through any book ever published on the subject of steam heating. It was the united efforts of all to help an individual out of his trouble.

There is one other thing that comes in in this connection. That is the status of employers in relation to the purely educational societies of stationary engineers. Employers are by no means bound to assist in the education of their engineers. Men get pay for what they know and can do; but there is nothing that so helps a man along and nerves him for better effort, as the knowledge of the fact that the man who pays him his salary, or wages, appreciates his efforts to always do better. It may be a curious fact, but it is a fact, nevertheless, that a man who receives the pay of another likes to know that his services are appreciated. Now when employers of steam engineers—or any other class of men, for that matter—see their men trying all the while to do better, spending their leisure time—perhaps burning the midnight oil—in becoming more proficient in their business, or in correcting some evil, it is as certain as anything can be that these men will appreciate some encouragement in what they are doing.

When an employer forgets this he makes a mistake—not a small mistake, but a large one.

To apply this to the stationary engineer, when his employer fails to recognize the fact that his engineer is working with all his energy, and to the extent of his ability, to reduce the cost of running his plant, he misses an important point.

The moral we draw from this is that the employer should co-operate with his engineer or engineers in giving him or them such encouragement as he can in perfecting his or their knowledge in the use of steam.

To put it more plainly, the employer of stationary engineers should encourage the societies of stationary engineers that have for their object the perfection of their membership in the production and utilization of steam. This granted, there is no better way to accomplish the end than for employers to be present at the open meetings of such associations, and to freely express their views on the subjects under discussion.

## Night Work.

Elsewhere we publish a communication relating to charges that should be made by a jobbing machine shop for work done for their customers at night. This is one of the puzzling questions that has many times come up to the managers of jobbing shops. For example, there is the wear and tear of the general machinery of the shop, which somehow the owner must get paid for. Then there is the cost of fuel, and the wages of the engineer—at overtime rates—all these things help to complicate the problem.

Such work, where one or two men work at night on a job that requires the use of power, is the most perplexing of any that can come to the foreman of a machine shop. Perhaps he finds it incumbent upon himself to loiter around for some hours watching the progress of the work. Then, as before stated, the cost of running the engine must somehow be accounted for, or the balance will be on the wrong side for the employer. And a good deal of the shop must be lighted to enable the work in hand to be done.

With considerable experience in this line of work, we must confess to never having arrived at a satisfactory solution of the problem. It was always an effort to strike a mean between a loss to proprietor and a charge that would seem exorbitant to parties so unfortunate as to be obliged to have their repair work done at night.

It is probable that every jobbing shop in the country makes some distinction between regular and transient customers. But in either case, so far as our experience goes, these small night jobs are a loss to all parties concerned; the customer pays a big price for his work, and the proprietor seldom gets paid for doing it.

There may be some general plan for charging for night work, with which we are not acquainted. If this is so, we shall be pleased to publish it for the benefit of our correspondent, and others. We commend the letter of our correspondent to the careful consideration of our readers.

## The Men Complain.

In the modern construction of warships the comfort of the men has come to be a matter of secondary consideration. The armament and the machinery—almost infinite in its parts and purposes—covers about all the available space, and "Jack" must take his quarters where there is no room for anything else. This he quite naturally objects to; hence it is getting to be a matter of difficulty, not to say impossibility, to properly man some of our new cruisers.

It seems to be quite in the nature of things for the naval architect to deal with anything besides the comfort of the men. He looks after the special mechanical appliances and the like, apparently forgetting that to work these appliances a superior quality of men are required, and that the kind of men needed must be given decent quarters, or they will not be forthcoming.

In the early days of our navy it was manned by men fully up to the requirements, but the requirements now are quite different from what they were then. Fighting on our war vessels will, in the future, depend largely upon machinery and its proper handling. It will not be a case of one-man or a dozen men's power. It will depend upon the possibility of getting the right kind of men to handle the modern machinery of a warship. And these men cannot be had unless they are treated with common decency. The Government must first do its duty, then the rest may be left to the citizens.

At present there is great complaint about the quarters on some of our new cruisers. This complaint is so great that men will not enlist in the navy unless assured what vessels they are to be assigned to. The complaint is one that should be looked into, with a view to remedying the trouble.

We are in this country accustomed to the belief that the hours of labor are materially less in Britain than they are here. And this in the main is probably true. But, after all, the matter of supply and demand seems to operate there about the same as here. For instance, a recent parliamentary inquiry into the hours worked by railroad employes in Britain appears to show that such men work considerably more hours there than here. The reason for this is that railway service is exceedingly popular there, and men seem willing to work any number of hours that the cupidity of the company demands.

At first thought it may appear that this matter—the hours of labor—should be settled by the contracting parties; but a little further consideration shows the fallacy of such reasoning. The public has rights in the matter which must be secured by legislation. Trainmen who are on duty sixteen or seventeen hours of the twenty-four—persistently—cannot properly attend to their duties.

But legislation in the matter is likely to be at fault. There may be instances where it is better for all parties that railroad men should be on duty for sixteen or more hours temporarily. But when this is the case this working time should be supplemented by a corresponding long period of rest.

Railroad companies can, perhaps, make more money by working their men excessively long hours, but the public has an undoubted right to object to this.

Our contributor, Mr. John J. Flather, who has been connected with Lehigh University, at Bethlehem, Pa., has accepted the position of Professor of Mechanical Engineering at Purdue University, Lafayette, Ind. This is a promotion for Professor Flather, and we believe one that is well deserved.

The plan of heating feed water for boilers by steam direct from the boiler appears to have been re-invented in England. It is an old plan in this country, Neafie & Levy, of Philadelphia, having employed it at least twelve years ago, and we never heard that they claimed any invention in the matter. There appears to be a slight saving in fuel in feeding water to a boiler, even though the water is heated by direct heat,

and the plates are saved from the strain of expansion and contraction.

It is expected that the launch of the new cruiser "New York," which will occur at the yard of the Cramps, some time in November, will be a big affair. It is intimated that a special train will be run between New York and Philadelphia on the occasion.

## QUESTIONS AND ANSWERS.

*Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.*

(453) O. E. P., New York, writes: A street railway party speaks in a letter about a 45 degree curve. What is the radius of this curve in the center of the track? *A.*—Approximately 127 feet 4 inches.

(454) H. E. B., Fairfield, Me., writes: Please inform me where there is a school that fits men to be marine engineers, and where I can obtain books for home study. *A.*—Your first question is indefinite; if you mean to learn engine running, there are no schools in which this is taught; the designing and construction of marine engines is taught in many of the technical schools, of which there are a number in different parts of the country. For books, see answer to Question 380, in our issue of August 20, 1891.

(455) W. J. C., Owen Sound, Ont., asks: In which of your issues treating on Modern Locomotive Construction is slide valve setting explained? *A.*—April 30, May 14 and 28, 1887. 2. Which do you consider to be a good work on the valve and link motion? *A.*—Slide Valve Gears, by F. A. Halsey, is a good book and suitable for practical men; but it does not treat on the link motion. Valve Gears, by H. W. Spangler, is another good book; this treats on valves and links, but in order to understand it you must have a fair knowledge of the higher branches of mathematics.

(456) J. R. G., Forest City, Pa., writes: I am making a brass whistle, but I do not know positively as to its dimensions. The bell is 16 inches long, 6¼ inches outside diameter. Will an internal diameter of 5¾ inches give too great a thickness? *A.*—The internal diameter is too small; we should make the thickness at the top of the bell about ⅛ of an inch, and reduce it towards the bottom to about $\frac{1}{14}$ of an inch by tapering the inner surface. 2. What should be the steam space in the bowl from which the steam strikes the bell? *A.*—About $\frac{1}{32}$ of an inch. You will find a drawing of a whistle in our issue of September 19, 1889.

(457) H. F. W., Zacatecas, Mexico, writes: Please inform me how far a man can go under water with the proper diver outfit in a shaft of 400 meters by 4 meters square. *A.*—In a diving-bell, men, after some experience, can readily work for several hours at a depth of 51 feet, or under a pressure of 2½ atmospheres, or 37½ pounds per square inch. But at 90 feet deep, or under 3.64 atmospheres, or nearly 55 pounds per square inch, they can work for but about an hour without serious suffering from paralysis, or even danger of death. Still, at the St. Louis bridge some work was done at a depth of 110½ feet; pressure 63.7 pounds per square inch.—*Trautwine's Engineer's Pocket-book.* 2. How much will an outfit cost? *A.*—Write to manufacturers.

(458) G. P. D., Vina, Cal., writes: I would like a little information in regard to a test of the compound engine described in your issue of September 24, current volume. You say that the engine working under given conditions developed a horse-power on 17½ pounds of steam per hour. What is meant by 17½ pounds of steam? Do you mean pressure? Or do you weigh the steam? I have seen these words used several times in your paper, but I could never understand it. I shall be pleased if you will enlighten me on the subject. *A.*—By 17½ pounds of steam is meant a quantity of steam weighing 17½ pounds; it does not refer to pressure. Since the weight of this quantity of steam does not change by converting it into water, we may use the word "water" in place of "steam," and in the above instance say that the engine will develop a horse-power on 17½ pounds of water. The weight of steam or water used per horse-power is computed from the quantity of feed water, which is carefully measured before it is fed into the boiler.

(459) A. D., New York, writes: I am about to build a boiler for an engine with a cylinder 3½ inches diameter and 4 inches stroke. The boiler will have ten sections containing 100 feet of 1-inch pipe. Each section consists of a vertical pipe 2 inches diameter, and the pipes of 1 inch diameter and 24 inches long are screwed into it at right angles; the other ends of each pair of the 1-inch pipes are connected by return bends. The ends of the 2 inch pipe are connected to a mud drum below, and to a steam drum above. Grate surface is 20x22 inches, and the distance from top of grate to lower tubes is 12 inches. This boiler and engine is for a small steam launch similar to the one described in your paper. Please let me know if the boiler will answer the purpose? *A.*—We believe it to be a very poor boiler, because the horizontal position of the 1-inch pipes will greatly retard the circulation, which may lead to serious consequences. It is also rather small for the engine. You will obtain better results with a vertical boiler of the proper proportions.

(460) J. C., Crawfordsville, Ind., writes: Please give rule for finding the safe working pressure of boiler flues 2, 3 and 4 inches in diameter. *A.*—The following formula is given by D. K. Clark for computing the collapsing superficial pressure in pounds per square inch on solid drawn iron tubes up to 6 inches diameter; thickness from $\frac{1}{15}$ to $\frac{1}{25}$ of diameter.

$$p = t \times \left(\frac{112{,}000}{d} - 12{,}000\right)$$

in which $p$ denotes the superficial pressure in pounds per square inch, and $t$ and $d$ the thickness and the diameter in inches. To illustrate: What will be the collapsing pressure of tube 2 inches in diameter, the thickness of metal being .083 of an inch? Substituting in the formula for the symbols their values, we have

$$p = .083\left(\frac{112{,}000}{2} - 12{,}000\right) = 3{,}652$$

pounds. In practice we should not allow more than $\frac{1}{10}$ of the computed pressure on a tube. Length, being an uncertain quantity, has been omitted.

(461) G. H., Albany, N. Y., writes: Please inform me what solution I can use to remove the sand scale from brass castings just after they are cast and removed from the flasks. *A.*—Make a solution of two parts of water, two of sulphuric acid, and one of nitric acid. Mix these as follows: First mix the water and sulphuric acid, and let these cool; then add the nitric acid; when this solution is cool it will be ready for use. Dip the castings, which are to be cleaned, in the solution, and withdraw them quickly; repeat this operation until the castings are bright; rinse in cold water, then in hot water, and finally throw them in sawdust to dry. If you simply wish to clean the castings without giving them a bright color, put them in a rattle-box with some gravel, and run the box half way immersed in water. 2. What kind of oil is used in mixing core sand? *A.*—Linseed oil is sometimes used. But generally a mixture of flour, rosin and beer in the proper proportions to suit the kind of work will answer all purposes. We know of a large brass foundry where oil is never used.

(462) W. J. D., Painesville, Ohio, writes: The tracing enclosed represents a screw-wheel for a boat; the lead of each wing is 2 feet 2½ inches, making 8 feet 10 inches for the 4 wings. At 50 revolutions per minute, how many feet will it advance? The red line represents the water line. I make it 441 feet 8 inches, but I think it must be more. *A.*—We understand your tracing to represent a disk 8 feet diameter, with 4 blades attached to its periphery; each blade extends around one-quarter of it, the total diameter of the wheel being 9 feet 2 inches. Since the entering edge of the blade is 2 feet 2½ inches in advance of the rear edge, it follows that the pitch of the blades is 8 feet 10 inches. If there is no slip, the wheel will advance at 50 revolutions 8 10″ × 50 = 441 feet 8 inches, and so far your figures are correct. But we notice that not one-half of the wheel is immersed; this will result in drawing a certain amount of air down with the blades, and cause the wheel to race; under these conditions the wheel will probably not advance more than 300 feet, if that much, in making 50 revolutions. Much of the power of the engine will also be expended in overcoming friction, so that on the whole the design of the wheel is a very poor one.

(463) W. K., ——, asks: Is there any way of determining the diameter and pitch of a propeller when the speed of the ship and the horse-power of the engine is given? *A.*—It is difficult to give rules for computing these dimensions which shall give satisfaction in every case. Opinions differ widely on the subject, and many men of ability have spent time and money making researches, and yet, with the present knowledge of the subject, mistakes are sometimes made in designing a propeller by very able engineers; much is always left to the experience of the designer. The propeller should always be fully immersed; hence its diameter should always be less than the draught of water at the stern. The following rule for computing the diameter is frequently used:

$$\text{Diam. of screw} = 20{,}000 \times \sqrt{\frac{I.\ H.\ P.}{(P \times R)^3}},$$

in which *I. H. P.* denotes the indicated horse-power; $P$ the pitch in feet, and $R$ the number of revolutions per minute. For computing the pitch, we have

$$\text{Pitch of screw} = \frac{737}{R} \times \sqrt[3]{\frac{I.\ H.\ P.}{D^2}},$$

in which $D$ denotes the diameter of the propeller in feet; the other notations are the same as before. The constants of 20,000 and 737 in the foregoing formulas change with different classes of vessels, and experience only will avail in making the proper choice of constants. 2. Is it practicable to run a propeller wheel as fast as 1,200 to 2,000 revolutions per minute? *A.*—No. 3. Is it true that a propeller running at a very high velocity will simply cut the water without tending to move the ship? *A.*—At very high angular velocity the propeller will have a slight tendency to move the ship, but by far the greater power will be expended in churning the water.

(464) E. B., Erie, Pa., asks: What should be the thickness of a wrought-iron ring 4½ inches inside diameter, and 2½ inches wide, to resist stretching due to the pressure of 38 screws ⅝ inch diameter, tapped radially at equal distances through the ring, the force on the screws to be as great as they can stand, without twisting off? Please give formula. *A.*—In a case of this kind, the thickness of the ring is determined by the number of threads required in the metal; this thickness will be greater than is necessary to resist pressure due to the screws. 2. How much will a 6-inch steel shaft deflect from its own weight, one end being 10 feet from the support? Kindly give formula. *A.*—We may consider this to be a beam supported at one end, and uniformly loaded, the load being equal to the weight of shaft. The formula for determining the deflection of a beam of this kind is

$$d = \frac{W \times l^3}{I \times E \times 8} \qquad (1)$$

in which $d$ denotes the deflection in inches; $W$ the weight in pounds; $l$ the length in inches; $E$ the modulus of elasticity, and $I$ the moment of inertia of the cross-section. The value of $I$ is found by multiplying the fourth power of the diameter of the shaft by .049. Thus, the diameter being 6 inches, the moment of inertia will be equal to $6 \times 6 \times 6 \times 6 \times .049 = 63.5$. The weight $W$ of the shaft is 955 pounds, and the value of $E$ is 25,000,000. Substituting in formula (1) for the symbols their values, we have

$$d = \frac{955 \times 120^3}{63.5 \times 25{,}000{,}000 \times 8} = 0.13 \text{ of an}$$

inch, nearly. 3. How deep should be the ratchet thread on a screw 1⅛ inch diameter, 4 threads per inch? Also how wide should the flats be, or would it be stronger to have the threads come to a sharp point? *A.*—In the ratchet or buttress thread, one surface is normal to the axis of the screw like the square thread, and the other surface is cut to an angle of 45 degrees to the normal one. If the threads come to a point at top and bottom, the depth of the thread will be equal to the pitch; but there is no strength gained by making the threads pointed; we should leave a flat surface at top and bottom, making the depth of the thread equal to $\frac{64}{100}$ of the pitch.

## BUSINESS SPECIALS

*Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.*

George B. Grant—Gear Wheels. See p. 20.

Link-Belting and Sprocket Wheels.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

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Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

$13.00 I. Dea L. Drawing Stands. The original. Send for postal. W. S. Rogers, Troy, N. Y.

To get the best work out of a Star Hack Saw, bear down heavily, and draw it very slowly.

S. A. Smith, 23 So. Canal St., Chicago, Ill., agent for Appleton Mfg. Co.'s Emery Grinding Machinery.

Our Automatic Gear Cutting Machine will increase production 50%. The Superior Mach. Wks, Clev'd, O.

Boston Gear Works, Boston, Mass. Gear cutting of every description; noiseless gears a specialty.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For the latest improved Eccentric Hook, Connecting Rods and Stub Ends, address T. C. Dill Machine Company, Philadelphia, Pa.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

Save small iron from foundry refuse. It pays. Use the Woodruff Pat. Separating Machine, Audubon Machine Works, New Haven, Conn.

"Twenty Years With the Indicator," by Thomas Pray, Jr. 10,100 sold. Price, $2.50. Order of bookseller; take no other.

For Sale—One 15 H. P. Double Cylinder, Double Drum, Friction Horizontal Hoisting Eng. with Boiler and fixtures; new. W. P. Davis, Rochester, N. Y.

Self-adjusting Hand-Screw for Pattern and Cabinet Makers, Wood Workers, etc. Sample by mail for 50 cents. Wm. H. Denney, Lancaster, Pa.

Valuable Books for Machinists and Engineers Send for complete Catalogue to Norman W. Henley & Co., 150 Nassau Street, New York.

25″, 32″, 37″, 42″ "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

The price of the No. 1 Universal Milling Machine without Overhanging Arm, made by the Brown & Sharpe Mfg. Co., Providence, R. I., is $480. Price of the Machine with Overhanging Arm $495. Previous prices, $550 and $585.

Complete treatise on Screws and Screw-making, with clear and concise explanation of the methods; 95 illustrations. Price, $1.25 postpaid. E. & F. N. Spon, 12 Cortlandt Street, New York.

"Hawkins' Calculations for Engineers," 10 Parts, 25c. each, bound, $2.50; Catalogue free; Theo. Audel & Co., Pubs., 91 Liberty St., N. Y.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Club Rates.—If no one is getting up a club for the AMERICAN MACHINIST in your town or establishment, send for Circular of New Club Rates, and try it yourself. Address AMERICAN MACHINIST, 96 Fulton St., New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2. postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

## MANUFACTURES.

There is talk of an electric light plant at Odebolt, Ia.

P. Tancreer & Company are erecting machine shops at Morgan, Texas.

The Bethlehem Iron Company is making big additions to its ordnance works.

The National Foundry and Machine Company has been organized at Louisville, Ky.

The Hamilton (Ont.) Light and Power Company will erect a $4,000 brick power house.

The Lexington (Ky.) Foundry Company will rebuild its stove foundry, recently burned.

Efforts are being made to interest foreign capitalists in the erection of a cotton-mill at Opelika, Ala.

Work has been begun on the Becker Manufacturing Company's mill to be erected at Fitchburg, Mass.

The old slipper manufactory, on Broadway, Bangor, Me., is to be occupied by a machinery plant.

The Ohio Car Wheel Foundry Company, of Toledo, O., has been incorporated with a capital of $50,000.

The H. Frank Steel Range Company, of Cleveland, O., has been incorporated, with a capital of $25,000.

The St. Paul & Duluth road will erect a $50,000 steel viaduct over its right of way on Lake avenue, Duluth.

The Electric Crane Company's new buildings, at Muskegon Heights, Mich., are rapidly nearing completion.

The Illinois Malleable Iron Company, of Chicago, has filed certificate increasing its capital stock to $200,000.

J. A. Colvin, iron founder at Worcester, Mass., will erect a new boiler house 54x18 feet, two stories high.

The Sperl Steam Heater Company, of Susquehanna, Pa., is talking of erecting a new and larger machine shop next season.

The Hurlburt Rogers Machine Company contemplate the erection of a new manufactory at Sudbury, Mass.

The plant of the Berlin (Conn.) Bridge Co. now covers twelve acres and nearly a thousand hands are employed.

Some further additions are to be built to the Farrell Foundry and Machine Company's plant, at Ansonia, Conn.

A $25,000 stock company will, it is stated, be organized for the purpose of erecting a cotton-mill at Gold Hill, N. C.

The Norton Iron Company, of Dorchester, Mass., is reported as to move to more commodious quarters at East Everett.

Wooster & Wilcox will operate a foundry and machine shop at Winsted, Conn., where a suitable plant is being erected.

The Thomson-Houston Electric Company, of Cincinnati, Ohio, has franchise to erect electric light plant in Hopkinsville, Ky.

The Williams Engine Company has been incorporated, with a capital stock of $50,000, to build the Williams engine at Baltimore, Md.

Tool works are reported as to be established in Moundsville, W. Va. The Moundsville Mining and Manufacturing Company is interested.

A new car wheel, recently patented, has a bright future. Capitalists are erecting a large shop for its manufacture, in West Indianapolis, Indiana.

The new plant of the Lookout Iron Company, at Harriman, Tenn., which has a daily capacity of 80 tons of finished material, has been completed.

The Superior Land Roller Company has purchased land at Gouverneur, N. Y., where it will erect a building for the manufacture of its goods.

Albert Pearre, John Waters, J. S. Boyd and others have incorporated, at Baltimore, Md., the Southern Electric Company, with a capital stock of $50,000.

Sutherland & Blackman are reported as erecting an addition to and as to put new machinery in their iron foundry and machine shop at Tallapoosa, Ga.

It is reported that a settlement of the affairs of the Talladega Iron and Steel Company will shortly be reached, and their blast furnace put in operation.

The plant of the Willson Aluminum Company, recently organized, now in course of construction at Spray, N. C., will have a capacity of 400 pounds daily.

It is stated that efforts are being made to raise $3,000 among the citizens of Port Washington, Wis., toward the establishment there of a brass foundry.

The Columbia Phosphate Company has been organized by South Carolina capitalists, to develop phosphate mines and erect a phosphate plant at Columbia, Fla.

The Ashland (Ky.) Steel Company's Bessemer steel plant, previously reported, has been completed, and will shortly be put in operation; daily capacity 400 tons.

The Paragon Mfg. Company have been incorporated at New Haven, Conn., with a capital stock of $16,000. The company will manufacture hardware, tools and specialties.

The Florida Pebble Phosphate Company, Kissimmee, Fla., has lately increased its capital stock from $50,000 to $100,000 to purchase more phosphate lands, erect plant, etc.

Mr. Harrison Soule, of Rochester, N. H., has recently purchased additional land adjoining his machine shop, and contemplates making an addition to his iron and brass foundry.

Plans have been prepared at Detroit, Mich., for a foundry and machine shop for the Brush estate, W. G. Thompson, trustee, to be of brick, 41x91 feet, three stories, and to cost $8,000.

P. L. Marden & Bros., of Oshkosh, Wis., are corresponding with Mayor May relative to the establishment of a factory for the manufacture of asphalt pavement in Augusta, Ga.

The Canda Manufacturing Company will establish extensive car building works at Carteret, N. J., which it is claimed will be the most thoroughly equipped of its kind in the country.

The Wallis Foundry Company, of Girard, Ohio, are making a number of improvements in their foundry, in order to keep pace with the demands made on them for their manufactures.

At Holyoke, Mass., plans have been prepared for a bicycle factory for the Keating Wheel Company, M. H. Whitcomb president, to be 60x230 feet, four stories, built of brick, and cost $30,000.

The capacity of the machine shops of the Mississippi Valley road at Paducah, Ky., is to be doubled very soon. The shops in that city are entirely too small for the work, which is steadily increasing.

The Oliver Iron and Steel Company, at Pittsburgh, Pa., will shortly vote on increasing its capital stock $400,000, to reimburse the company for improvements and to provide additional working capital.

The Norwalk Machine Works at Norwalk, Ohio, have consolidated with the Star Drilling Company, of Akron, Ohio, and the operations of the two concerns will hereafter be carried on at the latter place.

The recently organized Wichita Falls Iron Works of Wichita Falls, Texas, will operate general repair and construction shops. J. G. James is president; J. A. Kemp, vice-president, and L. B. Morrison, secretary.

It is stated that the Manganese Coal and Iron Company, of New Castle, Va., contemplate the construction of a blast furnace for making pig-iron and a furnace for making spiegeleisen in the near future.

W. P. Davis, Rochester, N. Y., publish a large illustrated sheet, upon which is shown a great variety of machine tools, boilers, engines and supplies generally, sold from their salesrooms in Rochester.

The Courtwright Manufacturing Company, of Detroit, Mich., manufacturer of railroad hand-cars and other supplies, will soon remove its works to Benton Harbor, where land has been purchased for new works.

The new plant of the Lookout Iron Company has been completed at Harriman, Tenn., and consists of twenty single puddling furnaces and three trains of rolls, and has a daily capacity of eighty tons of finished material.

Efforts are being made to organize a company to build an iron furnace in McMinn County, Tenn., to utilize the product of the McSpadden iron property, which is now being developed by J. T. Harris, of Birmingham, Ala.

The Victoria Iron Works, capitalized at $25,000, have been incorporated at Wichita Falls, Texas. J. G. James is president, J. A. Kemp vice-president, and S. B. Morrison secretary. The company will add a foundry to its works.

The Star Drilling Company, of Akron, Ohio, has increased its capital stock from $50,000 to $100,000. This company recently bought out the Norfolk Foundry and Machine Company's plant at Norfolk, Va., and will move it to Akron.

The Steele Signal Company, of Chicago, has been incorporated, with capital stock of $1,000,000, for the manufacture and sale of railway signal appliances and other mechanical devices. The principal stockholders are James W. Steele and Wm. F. White.

Ground has been broken for the Lufkin Rule Company's new factory at Saginaw, Mich. The main structure will be 165x41, with a 30x50 foot ell. It will be of brick, with stone foundations, will be two stories high, and will have 16,000 feet of floor space.

The Stanley Works (New Britain, Conn.,) have just moved into their new building, which connects with and forms an important addition to their old works. The new building is some five or six stories high, built of brick and adapted specially for their use.

The Elevated Tramway Co. has been incorporated by Chicago parties, for the construction of elevated tramways and appliances, on the Kelliher system. The capital stock is $125,000. The incorporators are A. T. Kelliher, John W. Bennett and D. W. Proctor.

The Chicago Crucible Steel Casting Company have sold their plant at Elston and Webster avenues, Chicago, to A. Egerton Adams, who has dismantled it of the machinery and equipment. The buildings will be converted to other uses than the manufacture of steel.

The Solid Steel Company, of Alliance, O., has recently made arrangements to manufacture the couplings of the Eureka Steel Car Coupler Company. The coupling weighs 185 pounds to the foot. A thorough test of it will soon be made on the Chicago & Northwestern Railway.

The Sewall Steel Heddle Company, capital stock $250,000, has been organized at Portland, Me., for the purpose of making machinery for manufacturing heddles and other machinery. The officers are: President, George W. Martin, of Lowell, Mass.; treasurer, Samuel Sewall, of Lowell, Mass.

The new shops of the Great Northern at Great Falls, Montana, will comprise the following: Machine shop, boiler shop and blacksmith shop 140x150 feet; office and storehouse 100x40 feet, and a twenty stall roundhouse. The buildings will be of brick. Contracts are about to be let for their erection.

The works of the Wrought Steel Car Wheel Company probably will be located at some point in New York, as many of the stockholders are New Yorkers. It was thought for a time that they would be erected in the vicinity of Pittsburgh, but it is now determined upon to build in the State above named.

The Reed Heading Machine Company has been organized at Portland, Me., for the purpose of manufacturing machinery and making of hogsheads, barrels, casks, etc. The company has a capital stock of $60,000, and its officers are: president William M. Mills, of Boston; treasurer, William W. Gooch, of Boston.

A certificate for increased capital stock of the American Steel Barge Company, Duluth, Minn., has been filed. The increase is from $2,000,000 to $4,000,000. Captain McDougall, the originator of the "whaleback" type of vessel, says that within a few weeks his yard will be at work on eight new vessels, six of them steamers.

The city of Rochester, N. Y., has been asked to further a proposition to extend the Charlotte Iron Works of that place, so as to include the manufacture of iron pipe, by subscribing $25,000 and the remitting of local taxes. The proposition has been favorably considered, and it is probable that the project will be carried through.

The plant of the Radford Pipe and Foundry Company at Radford, Va., is nearly completed, and it is expected that shipments of cast-iron water pipe will commence in November. Its capacity is 150 tons daily. The same company are operating under lease the large Anniston Pipe Works plant. They are running on large orders and making a heavy output.

At a meeting of the stockholders of the Pittsburgh Bridge Company, held last week, it was decided to increase the capital stock of the company from $100,000 to $250,000. Their business is constantly increasing, and at the present time they are turning out more work and have more orders on hand for future delivery than ever before in their history.

The furnace of the Duluth Iron and Steel Company, at Duluth, Minn., which was practically completed about two years ago, but never put in operation, has been leased for five years by Charles Himrod & Co., pig-iron dealers, of Chicago, Ill., and Crerar, Clinch & Co., and will be in operation this month. The output will be Bessemer pig-iron exclusively, for use by the West Superior Steel Works.

The Delaware Iron Company, owned and operated by Morris, Tasker & Co., of New Castle, Delaware, have decided to rebuild their plant, which was lately destroyed by fire, and have placed the contract with the Berlin Iron Bridge Company, of East Berlin, Conn., for the entire plant, which will be constructed of iron from the designs of the Berlin Company. The work is to be completed by December 1st.

The Johnson & Rust Boot Factory, located at Milford, Mass., long idle, is to be occupied as soon as necessary repairs can be made by a new business for Milford. The United States Nozzle and Coupling Company, of Syracuse, N. Y., has leased it, to manufacture nozzles and couplings for fire departments' use. The United States Navy is understood to be a heavy user of its productions. Possibly about forty hands will be employed at first.

A new four-story brick building is in course of construction by the Belden Machine Company, of New Haven, Conn. The new machine shop will be fitted with the latest improved machinery making a specialty of building work. In addition to the two machine shops, the same company is running a large stove plant at Salmon Falls, under the superintendence of Mr. E. M. Stevens. Mr. D. D. G. Langlands is superintendent of the two machine shops.

Two plants for dipping tin-plates soon will be in operation in Pittsburgh. One will be started by Mr. L. H. Smith, of the Carbon Bronze Company, this city, which will consist of two pots at the outstart. The other will be located at Wood's Run, in Allegheny, by a company of local capitalists, under the title of the Union Tin-plate Company. Four pots will be erected and terne plates or roofing tin will be turned out on a small scale at first, the company buying black sheets and dipping them. If the profit is sufficient the plant will be made permanent and also enlarged.

Work on the new band saw-mill now being erected by Singer, Nimick & Co. (Limited), proprietors of the Sheffield Steel Works at Pittsburgh, is progressing rapidly, and in a short time the plant will be ready for operation. It is being erected on a site 150 feet front by 175 feet deep. The new building is to be constructed entirely of iron, and nearly all the material is on the ground. The manufacture of band saws is carried on now in the other mills of this firm, but the present arrangements are incomplete, and all machinery of this kind will be removed to the new department.

## Experiments with Liquid Fuel.

The use of liquid fuel, or petroleum, instead of coal, for generating steam in the boilers of marine engines has been revived among steam engineers by the recent experiments with it on the English steamship "Erros" and the Italian steamships "Castelfedando" and the "Ancona." But the most successful use of petroleum as fuel in marine boilers has been on the English torpedo boat "Sunderland." This boat has a displacement of 86 tons, and is 137 feet in length. The boiler is of the ordinary locomotive type, with web bottom, the furnace front being arranged to receive the oil burners, which are 31 in number. The liquid fuel used is dumped from the double bottom (the tanks which hold the oil) and discharged into a small cylindrical tank, where it is subjected to an air pressure of 35 lbs. per sq. in., and whence it flows direct to the burners.

In the fire-room is an air compressor which discharges into cylindrical air tanks near the vessel's side, forming a group of four. The working pressure of air in these tanks is 40 lbs. per sq. in., and it is conveyed here for the purpose of disintegrating the oil as it leaves the burners. Each jet of oil gives a clear, bright flame, about 6½ ft. long and 9 in. in diameter, if burning alone. When the jets are combined in the furnace there is a bright mass of fire about 2 ft. from the furnace mouth to the tube plate. This flame entirely fills this portion of the furnace, and gives forth neither smoke, smell nor sparks, so that neither soot nor dust is deposited in the tubes, and no sweeping is required. Special precautions are taken to avoid the bad effects of high temperature and rapid changes of temperature, and it is stated that these are so efficient that, though the boiler has been repeatedly forced very hard, there has not been a sign of leakage about the boiler.

Assistant Engineer William H. Allderdice, on duty in the Naval Bureau of Intelligence, has given liquid fuel a close study, and has carefully investigated all of the reports on experiments with it. From these reports it would seem that the question of danger has been practically surmounted, and that the question of the use of liquid fuel is reduced to that of cost. At the same time the dangers from fire or explosion have not been entirely eliminated by experiments, and, although the cost of the liquid fuel is admitted to be greater than that of coal, this greater cost is partly offset by a reduction in the number of firemen, and in the expense also of their provisions and quarters. Lieutenant Allderdice quotes from a paper read before the Shipmasters' Society of London, on the use of liquid fuel, which in substance is: In England and America it is known as "residuum." It is the residue of crude petroleum, when all the volatile or lighter oils are distilled from it. It is perfectly non-inflammable, until heated to 350°, and, consequently, quite safe to use and carry in large quantities. It has no smell, as it does not emit gas until it reaches the required heat. It does not deteriorate by being stored in tanks exposed to the air, nor does it evaporate perceptibly. It is not detrimental to metal tanks, the inside skin of the vessel, nor any of the ordinary receptacles. The expert says: "One serious question of to-day is: How are we to fuel our men-of-war at sea during a blockade? It has been demonstrated that the successful transfer of coal at sea cannot be depended upon; besides, the modern men-of-war are not constructed for rapid coaling. With oil fuel the case is different; the large tank steamers could always fuel the fleet, even in heavy weather. To fuel a vessel of war in bad weather, the tank steamer could be made fast to the former by running a hawser from one to the other; a hose could be made fast along the line of the hawser, and the fuel be pumped into the ship's bottom at any rate desired."

The Italian government is continuing its experiments with oil fuel on vessels of war, and while no definite information is afforded as to technical details, it would seem that satisfactory results have been obtained. The Peruvian government has directed that the gunboat "Santa Rosa" be altered for burning oil in its furnaces. The British Admiralty are considering the advisability of burning oil fuel, but have not, as yet, decided what kind to use. The Navy Department will have some definite results on the use of oil fuel within the next few months, as it is the intention to have exhaustive experiments made with it by the Board of Engineer Experts at the New York Navy Yard.

The special advantages claimed for liquid fuel are: It has greater efficiency than coal, weight for weight; the manner of stowing it in the double or cellular bottoms gives increased stability to the vessel, and increase of available space for other purposes, now occupied for the stowing of coal; it will require a less number of fire-room force than with coal fuel, and there is no ashes nor refuse from oil fuel. In maneuvering under steam, it may often be desirable to stop suddenly while at full speed, and not to use the engines for some time. With coal fires this would be difficult, as they would have to be banked, and while lying dormant would become dirty; but with liquid fuel as many burners as necessary may be shut off when the engines are stopped, only enough being kept in operation to prevent the steam pressure from falling. When full power would be required it could be had at once with furnaces and everything clean and in good shape. —*Engineering News.*

### "The Chappell" Pipe Wrench.

Our readers are of course familiar with the "alligator" wrench, and know the principle upon which it works. In the wrench illustrated herewith an improvement is shown, the object of which is to secure a better grip of the pipe or stud, and at the same time to make it more easily released.

The jaw is made of the form shown by the detached view, which is a wedge with curved outline, the point being toward the front of the wrench. It fits to a seat provided for it, and is held in place by a small pin, which, by means of a slotted hole, allows it to move forward and back slightly. The effect of this is to wedge the jaw tightly in when stress is applied to the wrench, and when it is moved backward the first effect is to slide the jaw back and loosen it so that the wrench is immediately free. A further advantage is that the movable jaw may be easily removed for sharpening or renewal when needed. The body of the wrench is of malleable iron or cast steel; the jaw of tool steel, tempered.

The manufacturer is A. H. Anthony, Jewett City, Conn.

### A Take-up for Picture Frames.

Machinists, as well as others who have occasional experience with "house-cleaning time" and with moving, know what it is to try to satisfy the one who rules at such times in the matter of the proper hanging of pictures. A man who is perfectly at home when working to the thousandth of an inch or less with a micrometer finds that it is next to impossible for him to get pictures to hang on the wall at precisely the right height, absolutely, as well as in relation to each other.

Our illustration was made from the drawing of a mechanic, who, having experienced this difficulty, devised a way of overcoming it, which, it seems to us, effectually accomplishes the object sought.

At one side of the picture frame, at the back, in place of one of the usual eye-bolts, the device is placed and secured to the frame by the round-headed screw, as shown. Turning freely on this screw is the small cast disk shown, which is 1¼" diameter; it has wings on its outer face, by which it can be turned in the same manner as a wing nut, and on the other face two cam surfaces with square shoulders between them, as shown. The cord passes through a hole in the disk and is wound around the hub between the disk and the frame, as shown, one or the other of the shoulders at the back engaging with the cord to prevent it from unwinding. It is thus an easy matter to turn the disk a half revolution or more, winding or unwinding the cord until the picture hangs precisely right.

It is especially adapted to heavy pictures where a separate wire is used at each side, it being easy to level and adjust such pictures perfectly by it.

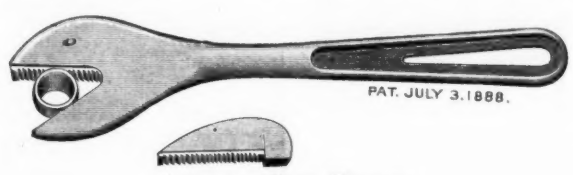
It is manufactured by the patentee, H. E. Billings, Hartford, Conn.

Unless one is actually brought into business relations with the great science of modern warfare, it is difficult to conceive of the terrible power of the latest and largest guns. These engines of destruction, weighing 110 tons, hurl a projectile of solid steel sixteen inches in diameter and nearly four feet long, at a velocity of 2,079 feet a second. When tested recently, one of these guns sent a shot through twenty inches of steel armor, eight inches of iron, twenty feet of oak, six feet of granite, eleven feet of concrete, and 3 feet of back. Comparatively, a locomotive weighing 200,000 pounds would have to spin along the tracks at the rate of 135 miles an hour to strike a blow equal to that projectile. Think of the damage wrought in a railroad collision where the train speeds along at the rate of thirty miles an hour, and one may calculate the destructiveness of modern ordnance.—*Boston Traveler.*

To the above should be added the fact that these great guns have pretty practically proved their uselessness, and that, for the present at least, smaller guns are more likely to be made. These big guns represented a sort of searching after the infinite, and according to all recent accounts the search has not been entirely successful. The big guns are said to be able to withstand no more than a few charges, and to bend and get out of shape very quickly. All present evidence is in favor of smaller guns.

### Delicate Thermometers.

Dr. Mayer, of Stevens Institute, returned lately from a trip abroad, and brought back with him the two most sensitive and expensive thermometers now in this country, for use in his experiments at the Institute. They were made by Baudin, at Paris, and are made of annealed glass that was subjected to high temperatures for five weeks, and slowly cooled for the same length of time, and are, according to their maker, the only two made in this manner in the United States. The more delicate one has a bulb unusually large, and an exceedingly fine tube, and will indicate fiftieths of degrees. In order to obviate the necessity of having the exceedingly long tube usual in the delicate instruments, there is an expansion of the tube located at a short distance from the bulb, and the graduation is recommenced immediately above it. This thermometer also indicates the height at which the temperature is taken, by means of a secondary scale. It has been found where the boiling point is for the different heights, and these are read on the secondary scale.



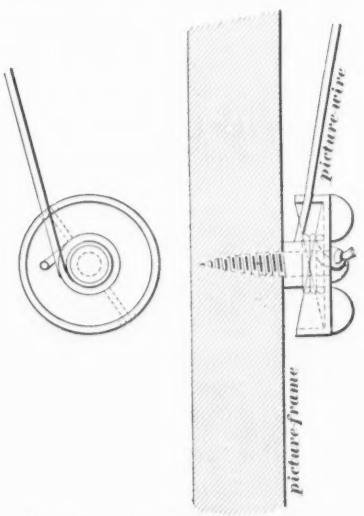

CHAPPELL PIPE WRENCH.

Dr. Mayer was put to a great deal of trouble to bring them with him, as to invert one of them is to ruin it, on account of the mercury lodging in the upper end of the tube. He consequently had to carry them in his hand the entire distance, save the voyage on the steamer.

Dr. Mayer also has in his laboratory at the Institute the most powerful magnet in the world. It is a small ten-pound steel electro-magnet; it is capable of holding over ten times its own weight.—*Evening Post.*

### Horses and Storage Batteries.

A valuable report on the working of surface railways by different methods of traction has just been made by the Birmingham Central Tramways Company, of Birmingham, England. This company operates a part of its system by electricity and a part by horses. The electrical equipment is composed of storage battery cars. It is found that the general expenses of electric traction, such as wages, fuel, stores, etc., are 10.3 cents per car mile, and adding machinery and car repairs the total expense is 14.74 cents per car mile.




TAKE-UP FOR PICTURE FRAMES.

With horse traction the general expenses aggregate 14.66 cents per car mile, or very nearly as much as the total expense for electric traction. For this part of the equipment of the car, repairs only cost 1.08 cents per car mile, making the total expense 15.74 cents per car mile. The advantage in favor of electricity stands at one cent per car mile, or about seven per cent. Actually it is greater, as under car repairs the whole equipment of the electric cars is included, whereas in the case of the horse cars the cars alone are referred to, the renewal of horses and harnesses being charged to another account. It appears from this that storage battery traction can compare favorably with animal traction when given a fair trial.—*Electricity.*

### Smokeless Powder.

An English officer, who has been a spectator of the late French maneuvers on the Italian frontier, after mentioning the difficulties he experienced from the character of the country and the lack of roads, writes as follows: "Another very great difficulty in the way of properly judging of the developments of the maneuvers is the use of smokeless powder. It seems to be hardly sufficiently realized what an extraordinary effect this must have in war. Again and again I found myself in a position where I could hear volley after volley, field guns, too, sometimes being fired probably within 800 yards of me, and yet I gazed intently for minutes trying in vain to discover the whereabouts of the firers. Noise is ever deceptive, and one moment you think the men must be close, but a puff of wind or some such cause may make the sound appear to come from miles off. If the men are at all hidden who fire, and are stationary, it would seem almost impossible to discover them at, say, 800 yards. In war time one would soon know whether they were firing at one, but in maneuvers the case is different. I was with a small party of men who descried a number of the enemy moving across the open about 500 yards off. Our party lay down and began firing volleys. The enemy stopped and turned in our direction. We noted certain movements of theirs, but could not make out for certain whether they were merely looking round to see where the firing came from, or whether they were firing back at us. The din of battle was going on all round, and it was impossible to tell by sound, and the flash was too indistinct to see. Surely the introduction of smokeless powder will affect tactics even more than did the employment of breech-loaders or percussion caps!"

### A Comprehensive Account of an Explosion.

A correspondent sends us the following, which bears all the marks of being a "press dispatch." It is decidedly amusing—barring the deplorable fatality—and will, we feel sure, be appreciated by our readers:

AN EXPLOSION AT PITTSBURGH.

ONE MAN FATALLY CRUSHED AND SEVERAL OTHERS SEVERELY INJURED.

PITTSBURGH, Oct. 13.—Park Bros.' Black Diamond stove works, at Thirtieth and Small streets, was the scene of a terrific explosion yesterday. The large triple valve, used to inject steam from the main boiler or reservoir into fifty-four smaller boilers, located in different parts of the works, exploded by reason of the presence of condensed steam. Huge pieces of boiler plate and debris were scattered in all directions. F. C. Ebling, an employe, was fatally crushed.

Several other employes were badly hurt and were removed to the West Pennsylvania hospital. Sixteen hundred men will be thrown out of employment till necessary repairs are made.

In regard to this our correspondent writes as follows:

To change Park Brothers' steel-mill into a stove works, by a single stroke of the pen, is bad enough, but when you get up a terrific explosion and fatally crush a man by exploding the triple valve that injects the steam from a reservoir into fifty-four boilers, and, too, exploding it with condensed steam, it's just awful; particularly when it throws the boiler plate around promiscuously, and 1,600 men out of employment.

It is said that recent improvements that have been made in the manufacture of sugar from the sorghum plant deprives the sugar of an objectionable flavor which it has previously had. It is also claimed that by the new process the yield is materially increased. The new process is thus, in part, described:

"Alcohol is mixed with the sorghum syrup, and after treatment the former is recovered by re-distillation, so that there is no appreciable loss. In the use of five barrels of alcohol, only a quart or so was lost. The sugar is nearly white, and it is strong in saccharine qualities—above 90 degrees."

### Machinists' Supplies and Iron.

NEW YORK, October 17, 1891.

Iron—American Pig—The market is quite unsettled, and there are a number of rumors that tend to make it sensitive. Among these is one to the effect that agents of southern furnaces are cutting prices in the East, taking what they can get for iron.

We quote: Standard Northern brands, No. 1 Foundry, at $16.75 to $18; No. 2 is selling at $15.50 to $16.50, and Grey Forge at $13.90 to $15. Southern brands of good quality are obtainable at $16 to $17.50 for No. 1 Foundry; $15.75 to $16 for No. 2; and $14 to $14.50 for No. 3.

Scotch Pig—We quote Coltness at $23, and Eglington at $20.50.

Antimony—Under the stimulus of a good consumptive demand prices are advancing.

We quote Hallett's, 10¾c; Cookson's, 14c.; L. X. 12c.

Copper—The demand for Lake is very light, though it is steadily held, with some indications of weakness, by the speculative element. Quotations are 12 25c. to 12 50c. Casting Copper is held at 11¼c. to 11½c. Arizona Ingot, 12c. to 12¼c.

Lead—No business of importance has been transacted, and the market is weak, nominal figures 4 47½c. to 4.50c.

Lard Oil—Prices are steadily maintained at 55c to 56c. for Prime City, Western, 54c. to 55c.

Spelter—Little is being done, and values are unsettled. Values range from 5c. to 5 05c.

Tin—Prices have been firmly maintained, notwithstanding that little has been done in the way of sales. Values in ton lots are about 20.2c.

## ✲WANTED✲

*"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.*

Wanted—A first-class marine engine draftsman by The Harlan & Hollingsworth Co., Wilmington, Del.

Mech. draftsman wants a situation: New York or vicinity preferred. A. O., care AM MACHINIST.

Position Wanted—To travel with or set up steam, hydraulic or electric machinery. Correspondence solicited. Traveler, AMERICAN MACHINIST.

First-class mech. draftsman, exp'd in steam plants, Corliss and slide valve engines, pumping and transmission mach'y, wants situation. "Z," AM. MACH.

Wanted—An engineer and machinist to set up engines; state experience, and wages expected. C. H. Brown & Co., Fitchburg, Mass.

Wanted—Position by a young (31) competent machinist; repair work preferred, or as stationary engineer; best of refs. BOX 84, AMERICAN MACHINIST.

Wanted, Position—Pattern maker and draftsman, 8 years experience; will go well recommended. Address L. B., AMERICAN MACHINIST.

Mech. draftsman, age 26, technical school grad with 10 years exp. as machinist and draftsman, wants perm't position. Box 83, AM. MACHINIST.

Wanted—A draftsman in a prominent eng. works who has had exp. in designing first-class machinery under good direction. Box 87, AM. MACHINIST.

Wanted—By a draftsman, 27, married, a change of position; N. E. States preferred; specialty turret machinery. Box 88, AMERICAN MACHINIST.

Wanted—By a first-class brass finisher, a position as foreman in brass department. Address Foreman, care AMERICAN MACHINIST.

Wanted—Situation by a young Swede; M. E.; 10 years' exp. in the drawing-room, and one year shop practice; A1 refs.; specialty, ordinary and special machine tools. Address "32 Years," AM. MACHINIST.

Boiler makers wanted; steady work at good wages to good all-around non-union workmen. Address Merrill-Stevens Eng. Co., 138-140 S. Bay Street, Jacksonville, Fla.

Young man (24) wishes to engage with a mfg. firm to take charge, travel or erect; is a practical machinist and tool maker; understands drafting, and a good talker; best reference. Box 86, AM. MACH.

Wanted, by a young man, position as sup't or to ass't in shop manufacturing fine machinery on the interchangeable system; expert on type-writers; 12 years experience in all branches; best of references. Address G., AMERICAN MACHINIST.

Position as foreman by a first-class mechanic of steady habits, age 32; understands the modern methods of getting out work quickly and economically by jigs, etc. Has executive ability; experienced; able to do drawing. Box 85, AM. MACH.

Wanted at Once—First-class tack and small nail maker to run seven Mongrels or Reed, and one Blanchard Machine on trunk and clout nails; state wages expected per day. Ohio Falls Rivet Co., Louisville, Ky.

## ✢ MISCELLANEOUS WANTS ✢

*Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.*

Cheap 2d hd lathes & planers. S. M. York, Clev'd, O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Special leather and cement for covering pulleys; no rivets required; local agents wanted. Crescent Mfg. Company, Cleveland, Ohio.

For Sale Cheap or Exchange—Eleven right and left modern Patent Automatic Cut-off Engine Patterns & Drawings, from 10″ to 20″. B 9, AM. MACH.

To manufacture light special machinery and tools to order by Orange Machine and Repair Works, Orange, N. J.

For Sale, Cheap—Patent for friction clutch pulley and cut-off coupling, patented March 24, 1891. J. Holmes, Box 586, Waterford, N. Y.

For Sale—The Aurora Foundry; new brick building, and everything in good order for light and heavy work. Address E. W. Wilson, Aurora, Neb.

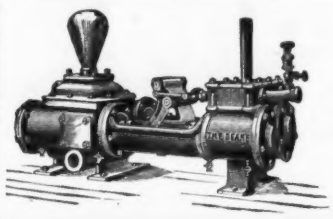
Corliss engs. and gen. mach'y designed, working drawings made. A. W. Jacobi, 136 Liberty St., N. Y.

Wanted—A1 machinist or pattern maker, to take an interest in my machine shop, to manufacture small engines. 2615 & 2617 Strand, Galveston, Texas.

Wanted—To receive proposals from manuf'r's to m'f'cture on royalty or buy my patent, No. 457,710; the only universal w'd workman's vise; a gem, indeed. J. T. Emmert, Box 313, Waynesboro, Pa.

For Sale—One 10″x12″ Ball Automatic Steam Engine, used several years, in good condition. Will sell cheap. Defiance Machine Works, Defiance, Ohio.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.

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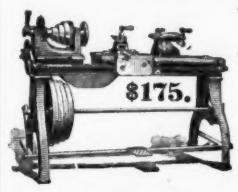


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WELDLESS
SMOOTH · COLD DRAWN
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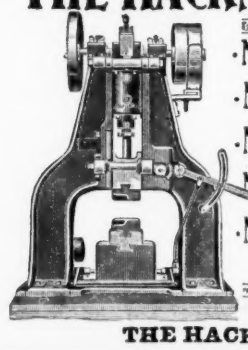
Its Manufacture and Uses.
By J. BUCKNALL SMITH, C. E.
400 pages, 150 illustrations. 8vo., cloth, . $3.00
JOHN WILEY & SONS, New York.

THE HACKNEY POWER HAMMER



- No Rubber Cushions to wear out.
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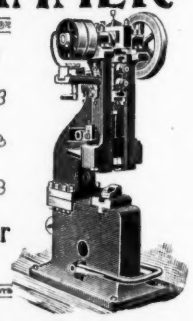

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Self Adjusting. Perfect Grip. Instant Release. Easily Repaired. For further information address the mfr.,
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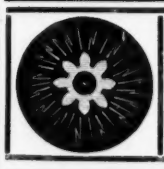

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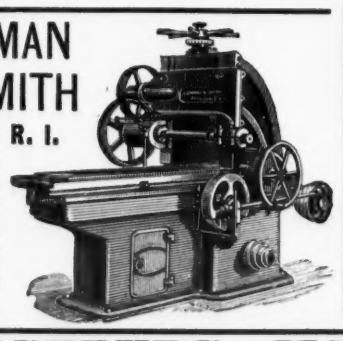

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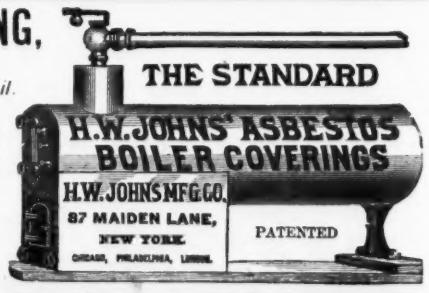


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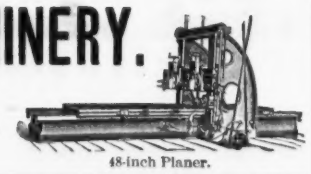
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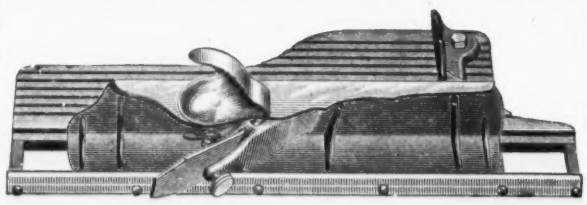

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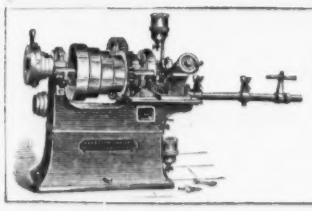

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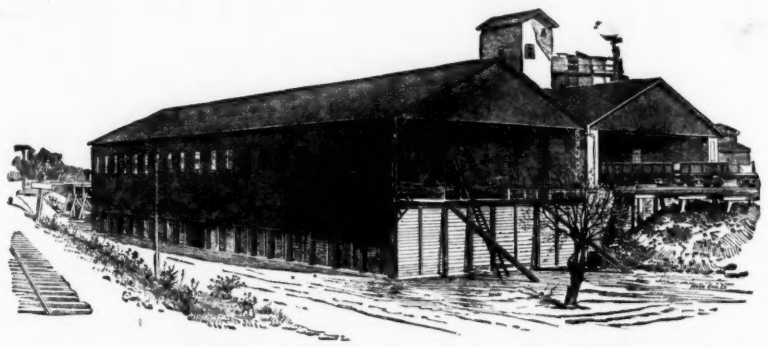

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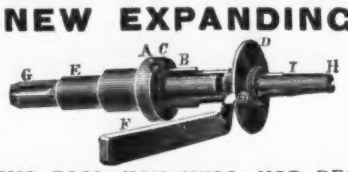


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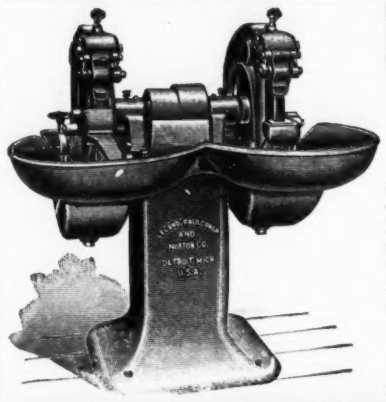

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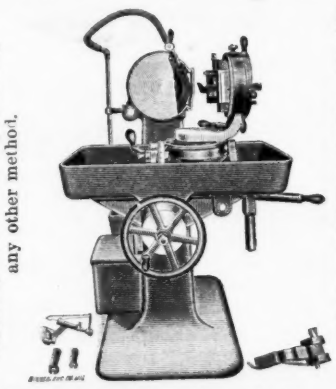

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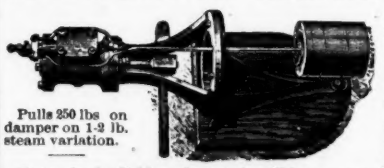

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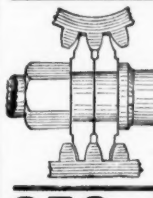

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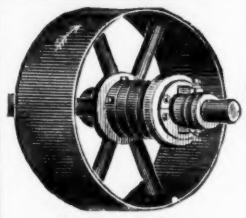

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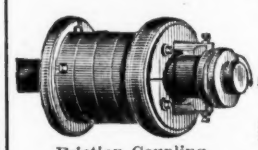

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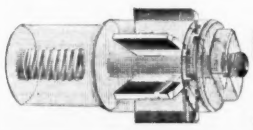

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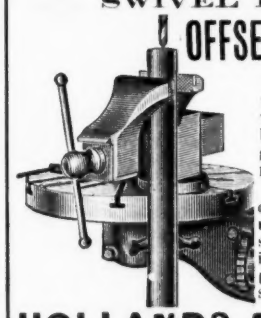

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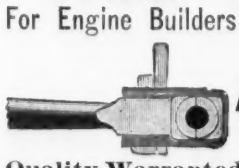

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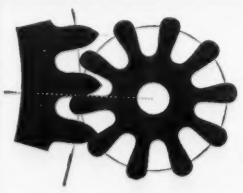

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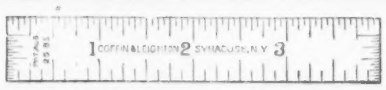


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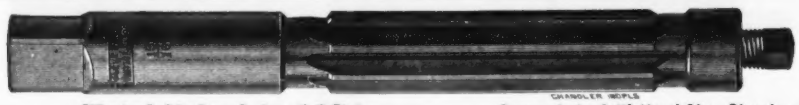

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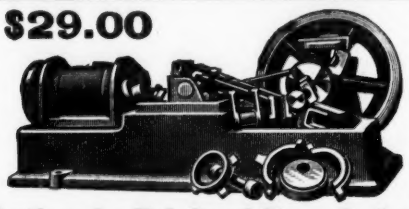
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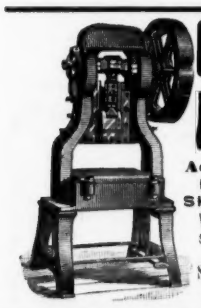
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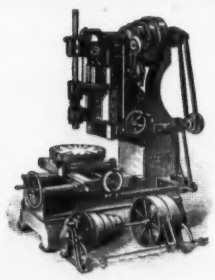
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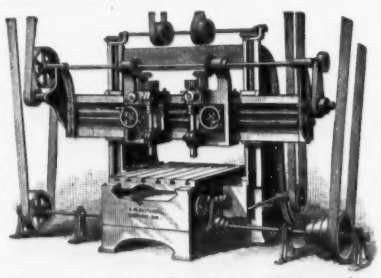
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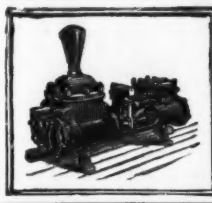
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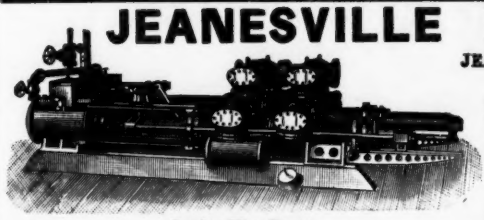
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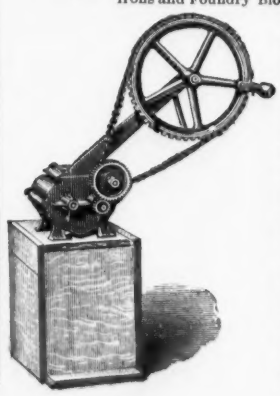
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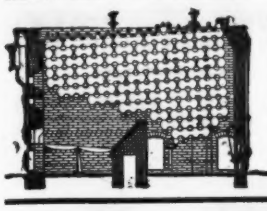

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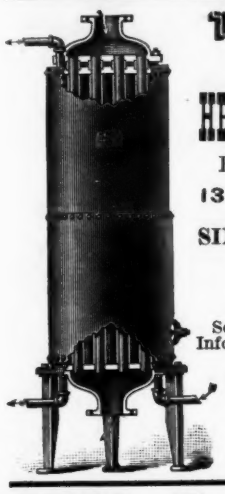

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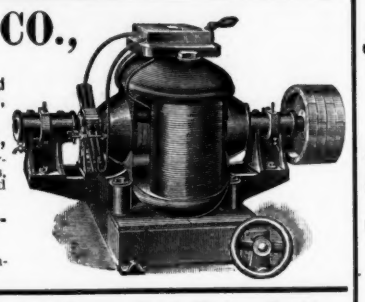

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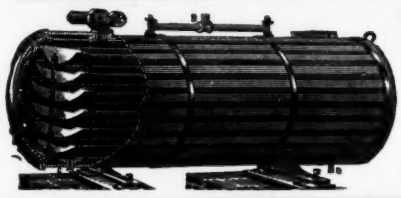

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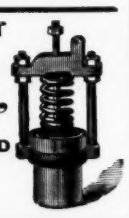

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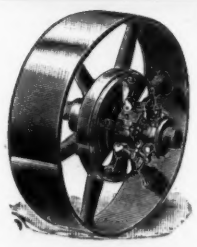

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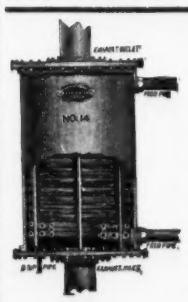

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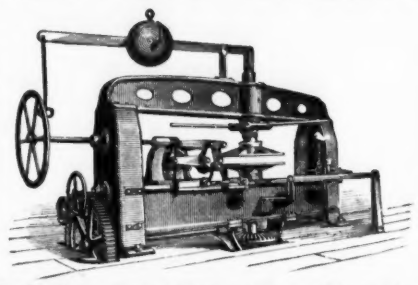

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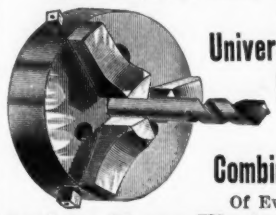

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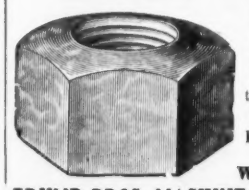

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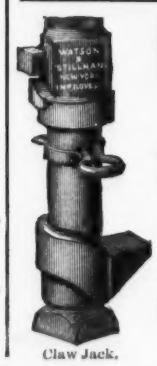


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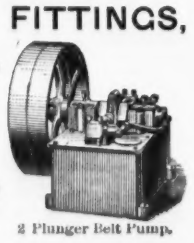

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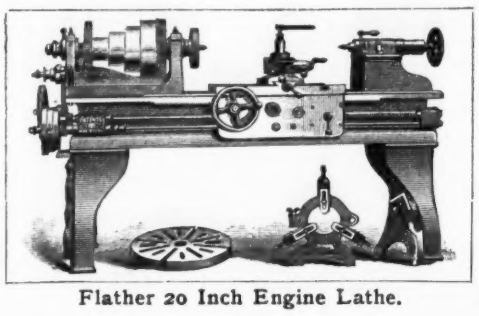

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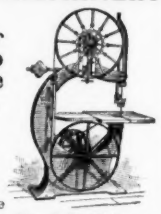

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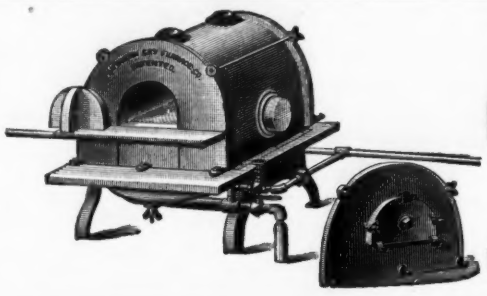

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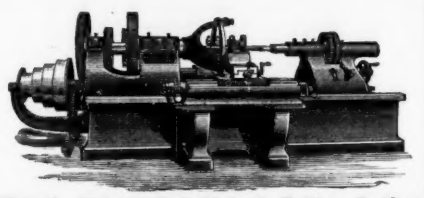

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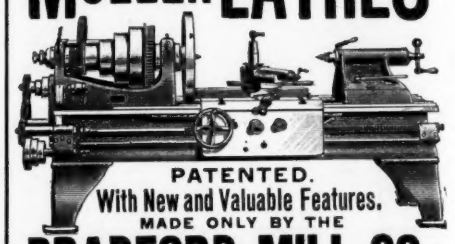

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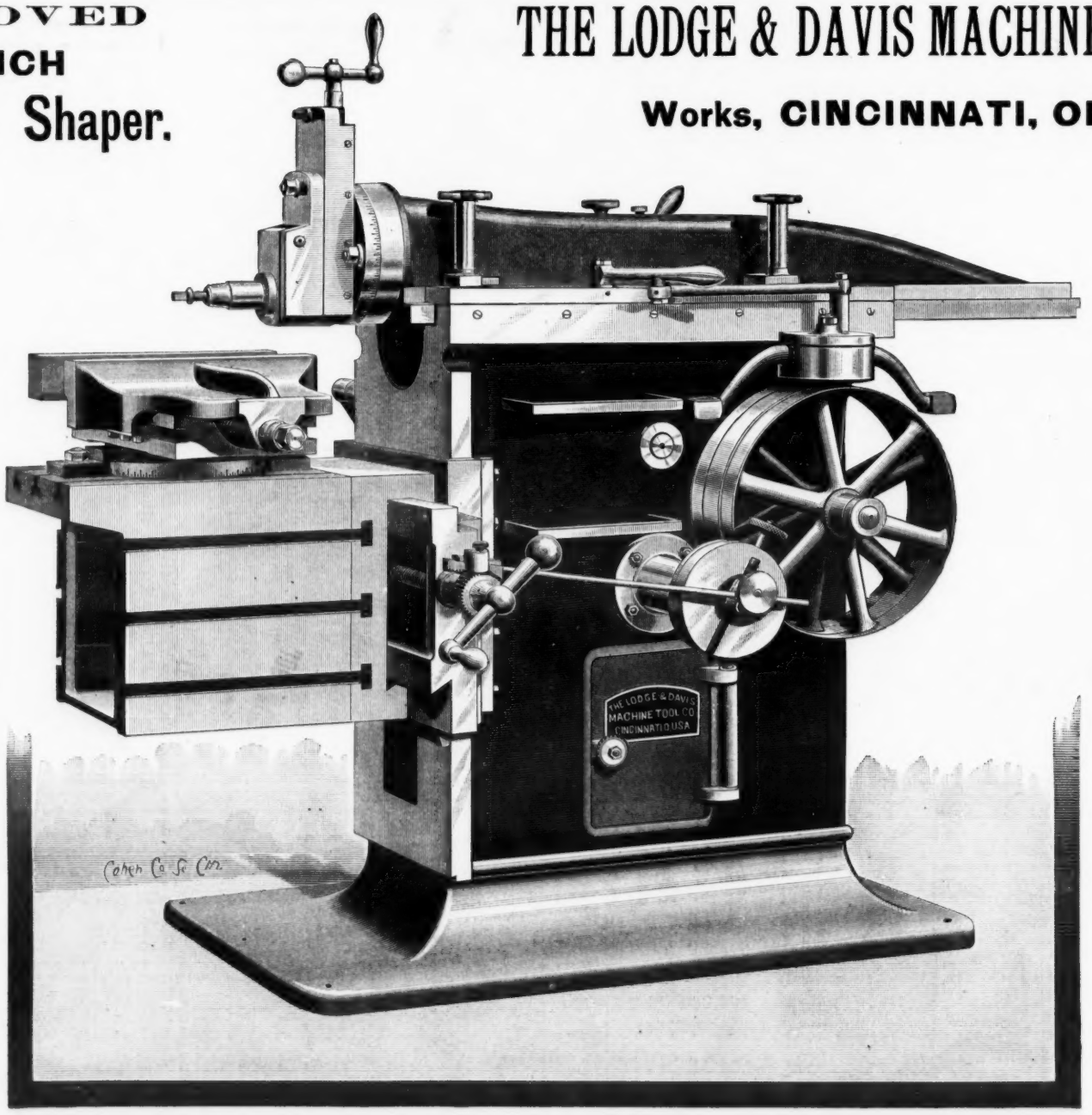


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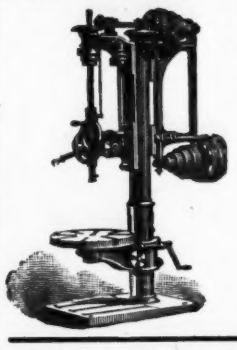

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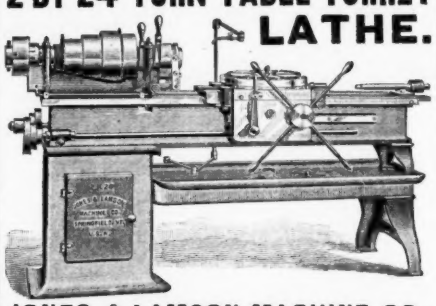

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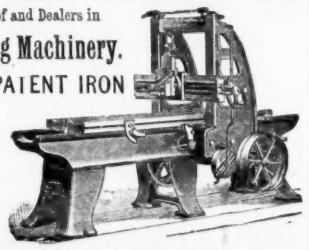

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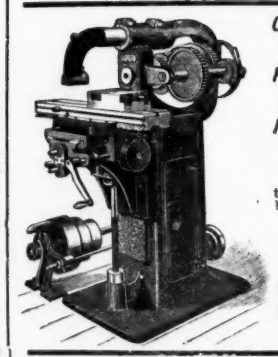

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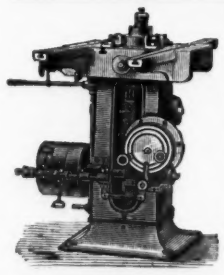

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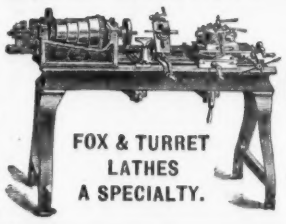


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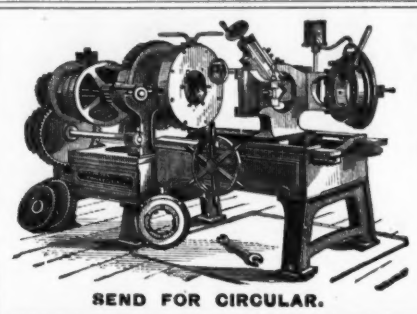

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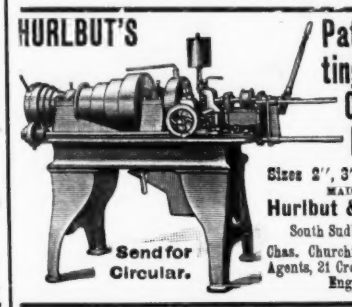


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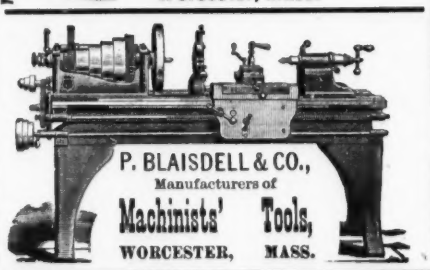


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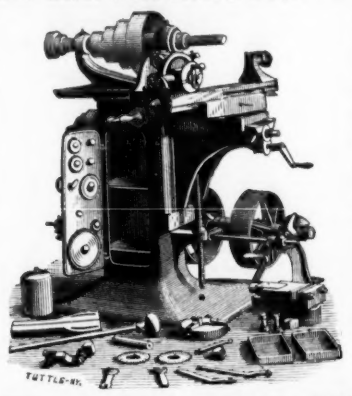

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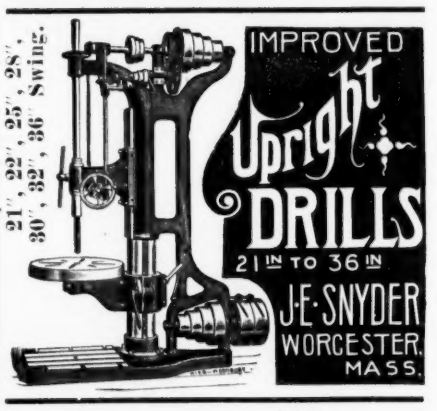


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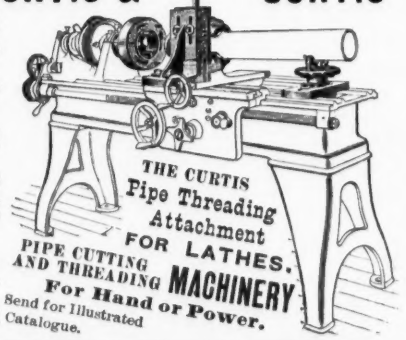


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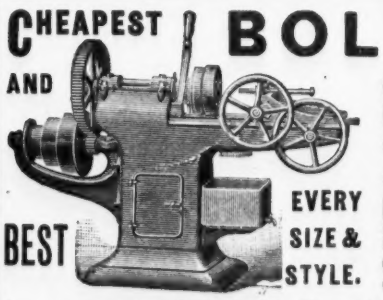

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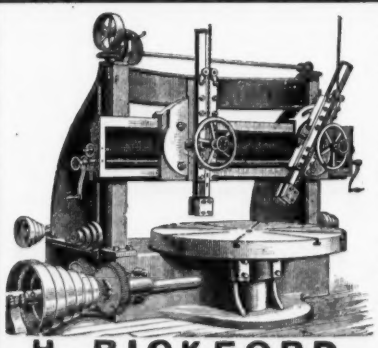

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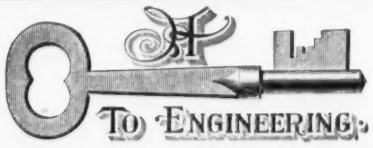


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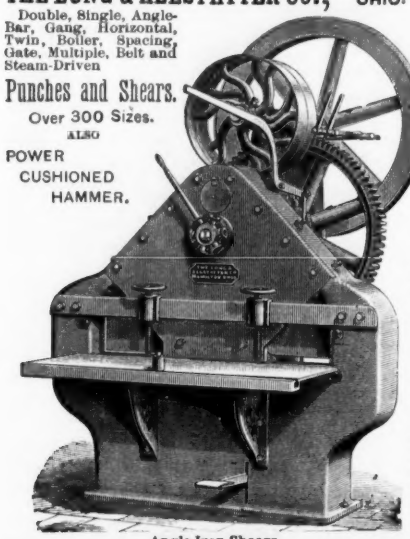
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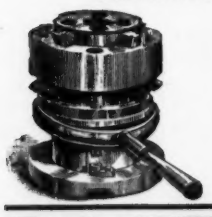
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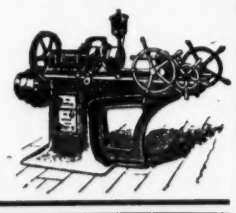

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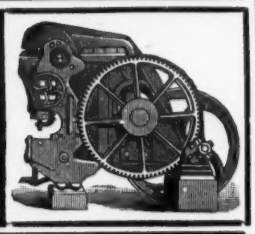

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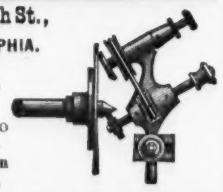

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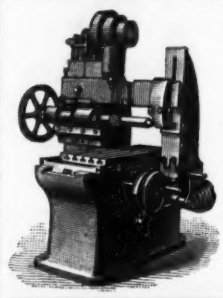
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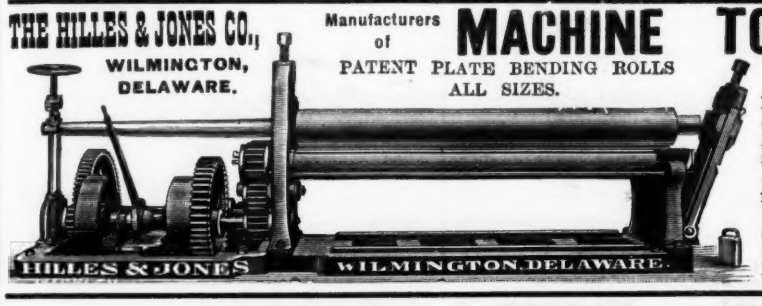


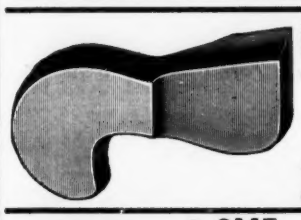
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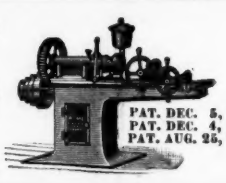
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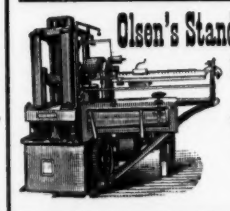
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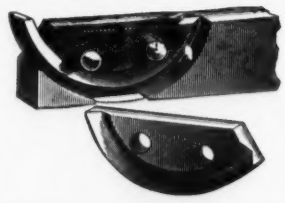
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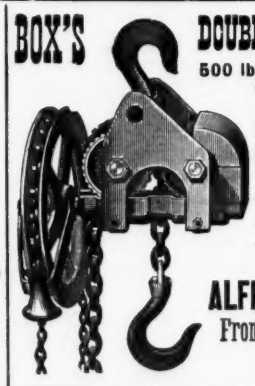
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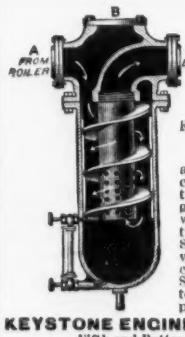

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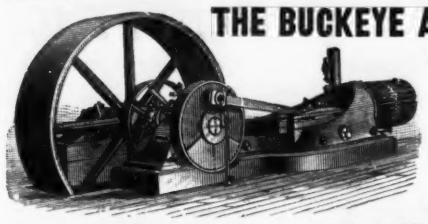

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SLOW SPEED, MEDIUM SPEED AND HIGH SPEED ENGINES,

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Complete Steam Power Plants of Highest Attainable Efficiency.

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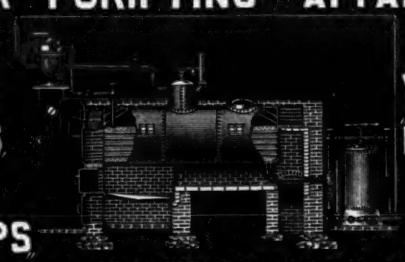

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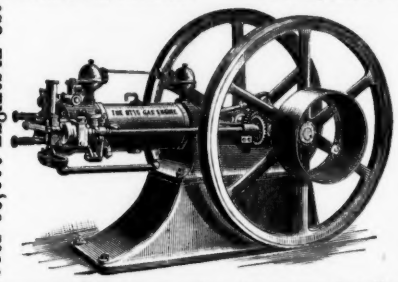

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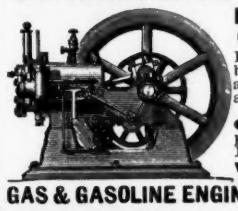

**Dwarfs in Size, but Giants in Strength.**

Expense one cent an hour per horse power and requires but little attention to run them. **Every Engine Guaranteed.** Full particulars free by mail Mention this paper.

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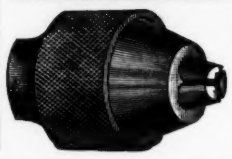

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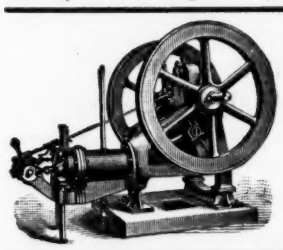

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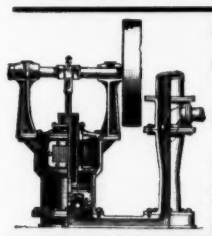

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No Air Locks. 15 to 50 per cent. fuel saved or equal amount of power gained. Runs with same economy as engine.
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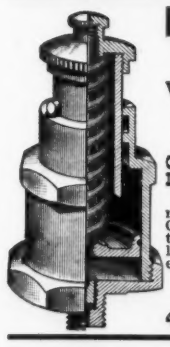

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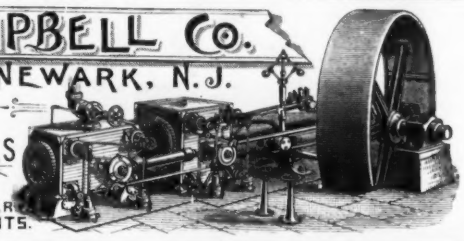

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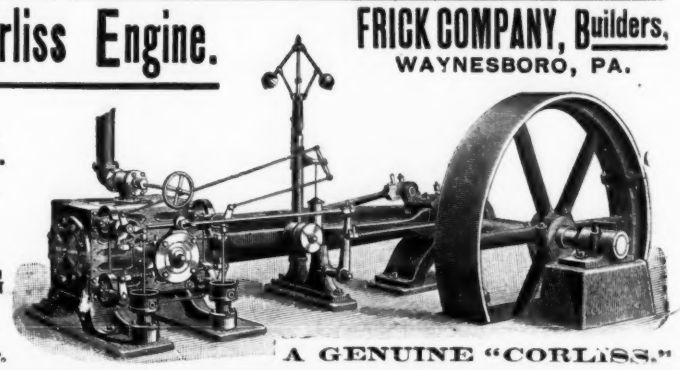

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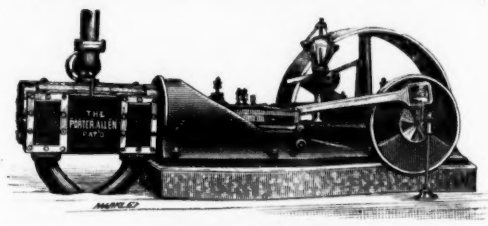

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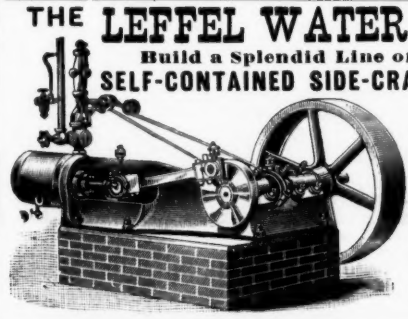

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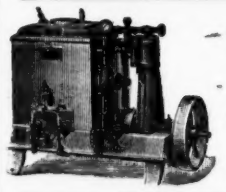

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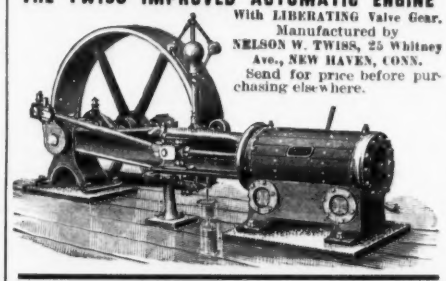

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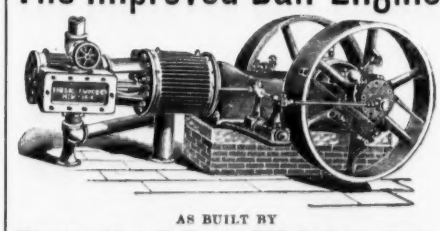

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| Two Double Stay Bolt Cutters, | Bement. |
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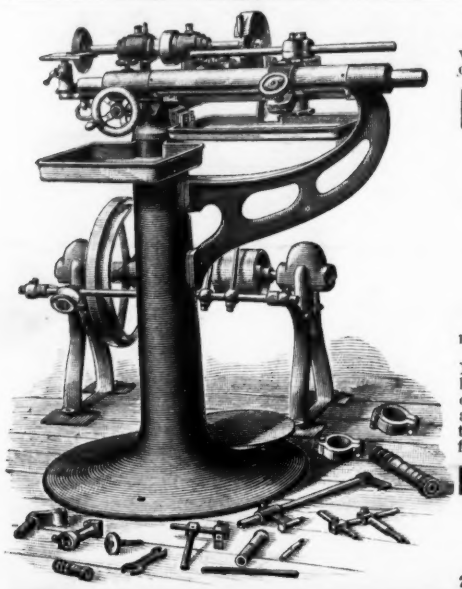

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## No. 3 UNIVERSAL CUTTER AND REAMER GRINDER,

with overhead works and everything shown in cut.

PREVIOUS PRICE, $260.00.

We have also reduced the prices of several other machines.

Our machines are made in large quantities (the No. 3 Universal Cutter and Reamer Grinders a hundred in a lot), and by the use of new process and expensive special tools much greater accuracy has been attained in their construction than can be reached by the usual methods of manufacture.

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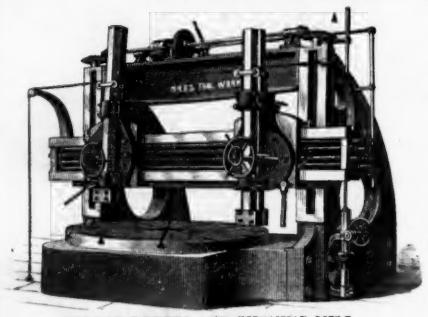
## MACHINE TOOLS.



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BORING AND TURNING MILLS
A SPECIALTY.

Built in sizes to swing from five feet diameter to thirty feet diameter. Housings are double-webbed. Table runs on heavy spindle supported by a truncated cone extending down from bed, making machine self-contained. Boring Bars counterbalanced at all angles. Feeds automatic at all angles.

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## The Original Unvulcanized Packing

CALLED THE STANDARD—As it is the Packing by which all others are compared.

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Complete with Taper Attachment.

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Write for large cuts with full descriptions.

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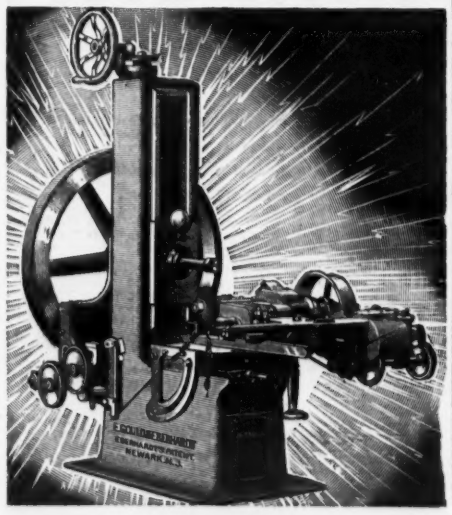
EBERHARDT'S PATENT.
With rare exception, this machine is cutting ALL

## ELECTRIC MOTOR GEARS

MADE.



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MANUFACTURE
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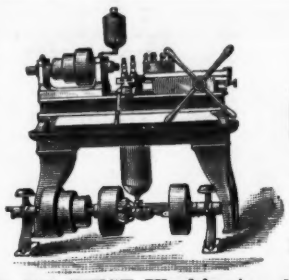
## Boring Mills,
48 in. and 66 in. Swing.



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For 5/8 in., 3 in. and smaller holes.

Revolving Head Drilling Machines.

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*FURNISHED IN TWO SIZES, EITHER SIZE WITH BENT OR STRAIGHT HOLDER.*

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THE LAIDLAW & DUNN CO.
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Yours respectfully,
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SPUR GEARED AND SPIRAL GEARED.

MANUFACTURED BY
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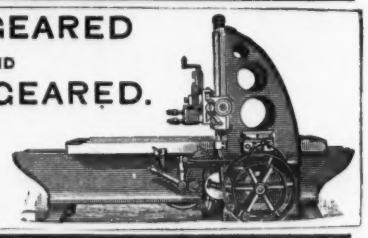

14" × 6' Engine Lathe. 16" × 6' Engine Lathe. 21" × 8' Engine Lathe.

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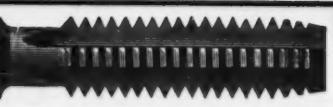
J. M. CARPENTER
PAWTUCKET, R. I.



Manufacturer —of— TAPS & DIES